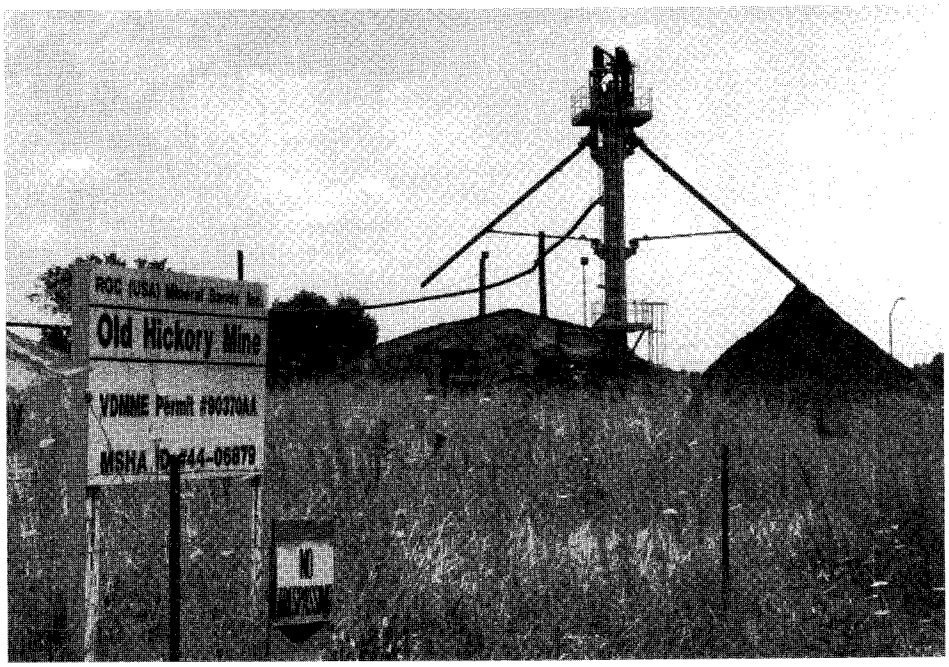
VIRGINIA DIVISION OF MINERAL RESOURCES

PUBLICATION 151

COAL, OIL AND GAS, AND INDUSTRIAL AND METALLIC MINERALS INDUSTRIES IN VIRGINIA, 1997

Palmer C. Sweet and Jack E. Nolde



COMMONWEALTH OF VIRGINIA
DEPARTMENT OF MINES, MINERALS AND ENERGY
DIVISION OF MINERAL RESOURCES
Stanley S. Johnson, State Geologist

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DIVISION OF MINERAL RESOURCES
CHARLOTTESVILLE, VIRGINIA
Stanley S. Johnson, State Geologist and Division Director
804-963-2308

STAFF
Kay T. Hasenauer, Executive Secretary
804-963-2309

ECONOMIC MINERALS AND ENERGY SECTION
Palmer C. Sweet, Section Head, 804-963-2313
Rebecca S. Hope, Geologist Senior, 804-963-2210
Jack E. Nolde, Geologist Senior, 804-963-2318
Roy S. Sites, Geologist Senior, 804-963-2320
Michael L. Upchurch, Geologist Senior, 804-963-2322

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James A. Lovett, Geologist Senior, 540-676-5577
William W. Whitlock, Geologist Senior, 540-676-5577

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Antoinette Arsic, Office Services Specialist, 804-963-2270

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John D. Marr, Jr., Geologist Senior, 804-963-2306
Vernon N. Morris, Cartographic Drafter Assist., 804-963-2324
Gerald P. Wilkes, Geologist Senior, 804-963-2323

INFORMATION: 804-963-2306

FRONT COVER: Old Hickory Mine of RGC (USA) Mineral Sands, Inc.-Virginia, with extracted titanium minerals (rutile and ilmenite) and zircon in the background and a field of wildflowers in the foreground, just northeast of Bolsters Store, Dinwiddie County (photograph by Rick Berquist).

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COAL, OIL AND GAS, AND INDUSTRIAL AND METALLIC MINERALS INDUSTRIES IN VIRGINIA, 1997

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INTRODUCTION

The total value of mineral production in Virginia in 1997 was almost 1,702.58-million dollars (Table 1; Figure 1). About 959.12-million dollars resulted from coal sales, a 1.57-percent decrease in value from the 1996 figure of 974.36-million dollars. About 143.46-million dollars was produced from the sale of crude oil and natural gas, with the remaining 600.00-million dollars from production of industrial rocks and minerals (Tables 2, 3 and 4). The total value represents a 47.7-million dollar increase for 1997, when compared with 1996. The value of crushed stone was up 15.9 percent, the value of sand and gravel was up 22.3 percent, and the value of lime was up 7.8 percent.

Crude oil production was down 29.2 percent, while natural gas production was up almost 7.3 percent. On a slight increase was the production of clay materials. Virginia led the nation in the production of kyanite; was the only producer of a feldspar, marketed as "Virginia aplite"; and was one of two states mining vermiculite. Virginia also ranked seventh in crushed stone production, ninth in lime production, and 32nd in the production of sand and gravel. Granite was the most extensively mined material in 1996, followed by limestone, traprock, sand and gravel, and sand. These five mineral commodities accounted for 89.5 percent of the total nonfuel mineral production in 1996. Several mineral commodities, including iron oxide, manganese, mica, perlite, and phosphate rock were imported for processing.

Table 1. Mineral resource production in Virginia, 1997.

MINERAL COMMODITY	QUANTITY	VALUE (thousand)
Clay[1] —short tons—	950,183	$3,340
Coal (bituminous)[2] ($25.99/ton) —thousand short tons—	36,889	$959,120
Lime[1] —thousand short tons—	853	$46,200
Natural gas[2] ($2.46/Mcf)—million cubic feet—	58.246	$143,291
Petroleum (oil)[2] ($16.06/barrel) —42-gallon barrel—	10,337	$166
Sand and Gravel[1] —thousand short tons—	12,455	$54,200
Stone:		
Crushed[1] —thousand short tons—	72,752	$392,000
Combined value of cement, clay (fuller's earth), dimension stone, feldspar, gemstones, gypsum, industrial sand and gravel, iron oxide pigments (crude), kyanite, sulfur, and vermiculite[1]	XX	$104,000
TOTAL	XX	$1,702,576

XX, Not applicable, p/preliminary, NA, Not available
[1] Measured by mine shipments, sales, or marketable production (includes consumption by producers) - from U.S. Geological Survey.
[2] Virginia Department of Mines, Minerals and Energy

The number of producers and the number of processing plants remained constant during the year for cement, feldspar, gemstones, gypsum, industrial sand, iron-oxide pigments, kyanite, ornamental aggregate, sand and gravel, and vermiculite.

INDUSTRIAL AND METALLIC COMMODITIES

Industrial minerals and rocks, other than mineral fuels, were produced in a total of 92 Virginia counties/cities in 1997. The combined value of all nonfuel commodities sold in 1997 was 600-million dollars. In 1997, 251 companies operated 359 industrial-mineral mining operations. Thirteen of the 251 companies produced more than one mineral commodity from 159 operations. These thirteen companies produced 51,293,523 short tons of industrial minerals, or 54.2 percent of the total production. Of the 159 multiple industrial-mineral operations, 37 operations produced sand, 31 operations produced limestone, 33 operations produced sand and gravel, 28 operations produced granite, 5 operations produced traprock, 3 operations produced sandstone, 6 operations produced shale, 2 operations produced clay, 1 operation produced diabase, 1 operation produced basalt, 1 operation produced greenstone, 1 operation produced feldspar, 1 operation produced quartz, 1 operation produced quartzite, 1 produced dolomite, 2 operations produced slate, 2 operations produced kyanite, 2 operations produced iron oxide, and 1 operation produced marl.

The total average annual employment reported in 1997 for industrial mineral and rock operations was 4,855 individuals. Industrial mineral and rock production employees worked an average of 234 days in 1997. Total wages of $126,588,955 were paid to a total of 4,855 employees (4,076 production employees and 779 nonproduction employees). The average annual wage earned by all employees was $26,074, based on those employees for whom wages were reported. The average annual wage for production employees was $25,034 and for nonproduction employees was $31,516.

CEMENT

Three companies produce cement in Virginia. Roanoke Cement Company operates a plant in western Botetourt County and manufactures portland cement from locally

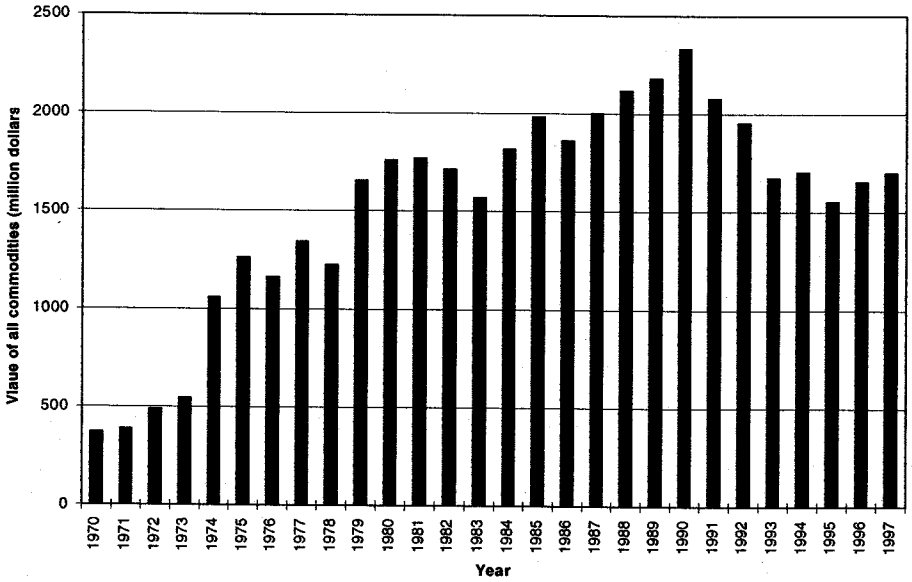


Figure 1. Total value of mineral production in Virginia, 1970-1997.

mined limestone and shale and purchased iron scale from Roanoke Electric Steel Company. Calcium and iron-aluminate-clinker is manufactured in five coal-fired kilns and ground into cement. Three-fourths of the cement is sold to local ready-mix companies. The Riverton Corporation in Warren County produces masonry cement at its plant north of Front Royal. Limestone from the Edinburg Formation is crushed, calcined, hydrated, and mixed with portland cement from out-of-state sources to produce masonry cement that is sold to building supply dealers in Virginia and surrounding states. LaFarge Calcium Aluminate, Inc. operates a cement manufacturing plant in the City of Chesapeake using imported cement clinker from France. The clinker is ground and made into six types of calcium-aluminate cement at the facility. The advantages of this cement include rapid hardening, resistance to wear and corrosion, and it can be used under a wide range of temperatures.

CLAY MATERIALS

Residual and transported clay, weathered phyllite and schist, and shale are used as raw material to produce bricks in Virginia. About 950,183 short tons of clay (exclusive of fuller's earth) was produced in Virginia in 1997 (Figure 2). The annual total capacity of all brick plants in the Commonwealth is almost one-half-billion bricks. The clay material industry in the western part of the state mines Paleozoic-age shale primarily to produce face-brick. Face-brick producers, in the central-to-eastern part of Virginia, mine Triassic-age shale and clay residuum in Orange and Prince William Counties. They also mine Precambrian-age schist and residual and transported clay in Amherst, Brunswick, Chesterfield, and Greensville Counties.

Lightweight aggregate is produced in Buckingham and Pittsylvania Counties. Solite Corporation, in northern Buckingham County, uses the Arvonia Slate to produce lightweight aggregate. Virginia Solite Company mines Triassic-age shale southwest of Danville in Pittsylvania County, to produce a similar product.

Bennett Mineral Company, in the Walkerton area of King and Queen County, in eastern Virginia, mines and processes montmorillonite (smectite) clay to produce an industrial and sanitary absorbent. The facility uses wood waste as a fuel to dry the clay in a rotary kiln. The Golden Cat plant of Ralston Purina, located near Manquin, King William County, began producing cat litter in the summer of 1997. Brands of cat litter produced include Tidy Cat, Tidy Scoop, and Scamp. More than 70,000 short tons of montmorillonite clay (fuller's earth) were mined for production of cat litter in the Commonwealth during 1997.

CONSTRUCTION SAND AND GRAVEL

Construction sand and gravel producers accounted for 12.5 million short tons of material in 1997 at a value of 54.2 million dollars (Figure 3). The construction sand and gravel production figures were almost 11.2 percent higher than in 1996. Sand and gravel are extracted from river terraces and dredged from the rivers in eastern, central, and western Virginia. Some construction sand is also produced from Carroll, Craig, Rockbridge, Smyth, and Warren Counties in the west-

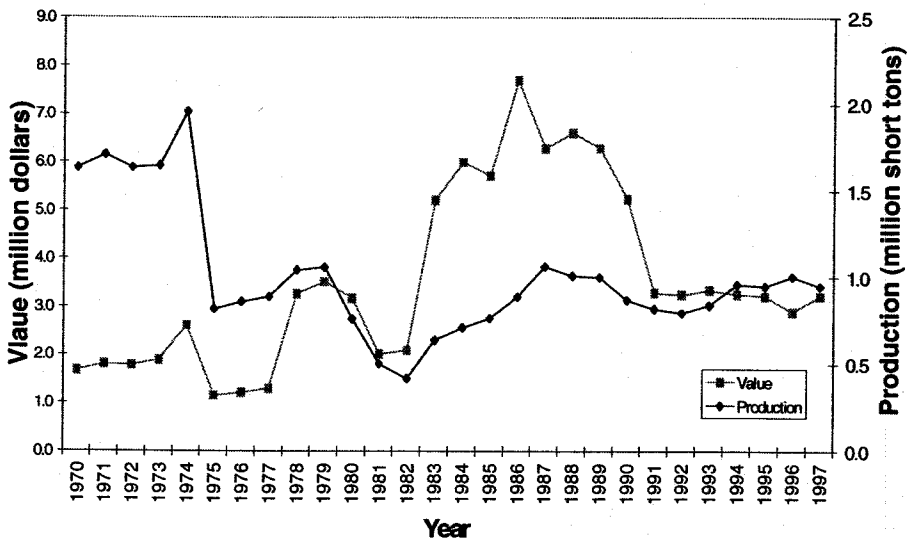


Figure 2. Trend in clay material production and value, 1970-1997.

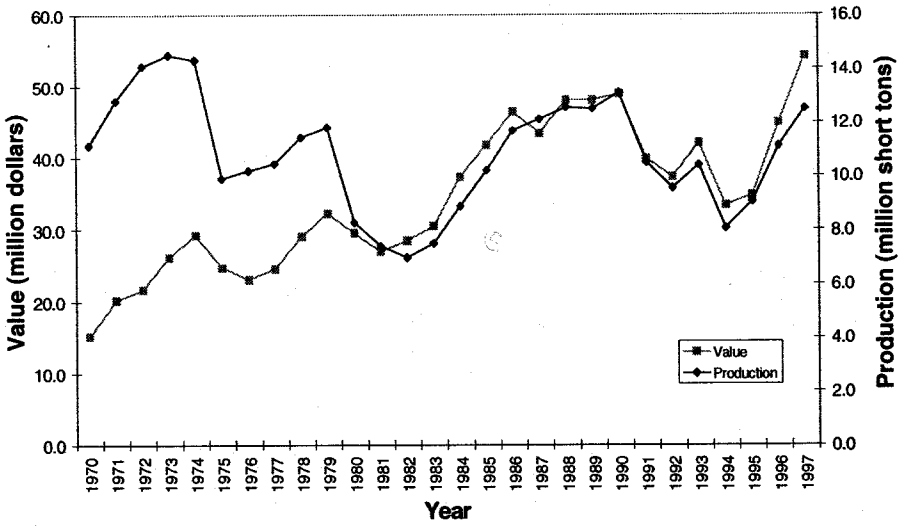


Figure 3. Trend in sand and gravel production and value, 1970-1997.

ern part of the State, in the Blue Ridge and Valley and Ridge provinces. Large tonnages of construction sand and gravel, from southeast of Fredericksburg, are shipped by rail to the northern Virginia-Washington.D.C. market area. A large portion of the production by the Tidewater Quarries, Inc. and Tarmac Mid Atlantic, Inc., near Richmond is barged down the James River to the Norfolk area. Rail and truck also make shipments to the western part of the Commonwealth. Construction sand (concrete and masonry) is also produced from operations that crush and process sandstone.

CRUSHED STONE

More than 72 million tons of crushed stone including limestone, dolostone, sandstone, quartzite, granite, gneiss, diabase, basalt, greenstone, slate, "Virginia aplite," and marble, were produced in Virginia in 1997 (Figure 4). Virginia's crushed stone production was valued at 392 million dollars and it was the seventh leading producer in the United States. Crushed stone production figures for 1997 in Virginia were 13.8 percent higher than figures for 1996.

Producers of limestone, dolostone, shale, sandstone, and quartzite are in the Valley and Ridge and Appalachian Plateaus provinces in the western part of the Commonwealth (Figure 5). Principal end uses for these commodities were for roadstone, concrete aggregate, asphalt stone, and agricultural application. Mine safety dust is produced in southwest Virginia from limestone. Safety dust is used in coal mines to coat the roof, walls, and floor to prevent coal dust explosions. The safety dust should contain less than 5 percent SiO_2 and 100 percent should pass 20 mesh, with 70 percent passing 200 mesh. Several operations also market finely ground dolostone and limestone for use as a filler material.

Shale is excavated in Frederick and Rockingham Counties for use as local roadstone and fill material. Sandstone and quartzite are quarried in Carroll, Culpeper, Pittsylvania, and Wythe Counties for production of roadstone, concrete aggregate, asphalt stone, and manufactured fine aggregate.

Granite, gneiss, diabase, slate, and marble are quarried in the central part of Virginia. Major uses of these materials are for roadstone, concrete aggregate, and asphalt stone. The Solite Corporation crushes slate for lightweight aggregate near Arvonia in Buckingham County. LeSueur-Richmond Slate Corporation increased production of crushed slate, as a by-product of dimension slate operations, for local highway construction. Appomattox Lime Company, Inc. quarries marble (Mt. Athos Formation) near Oakville in Appomattox County for agricultural lime.

Fines produced at quarries in the Petersburg and Red Oak Granites, in the southern part of Virginia have been used for low-grade fertilizer. Chemical analyses of these granitic materials from Brunswick and Nottoway Counties in the southern Piedmont province show a K_2O (potash) content higher than 10 percent. Potassium-aluminum feldspars (orthoclase and microcline), common in igneous and metamorphic rocks, release potassium upon weathering. Additional uses for these fines are for roads, bedding for concrete pipe, bedding for plastic liners in landfills, and for warning tracks for baseball fields (Figure 6).

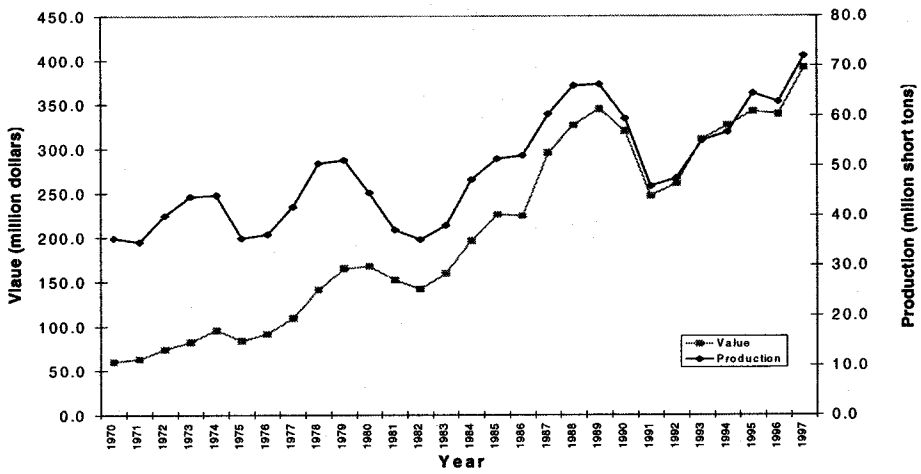


Figure 4. Trend in crushed stone production and value, 1970-1997.

DIMENSION STONE

Slate, diabase, quartzite, and soapstone were quarried for dimension

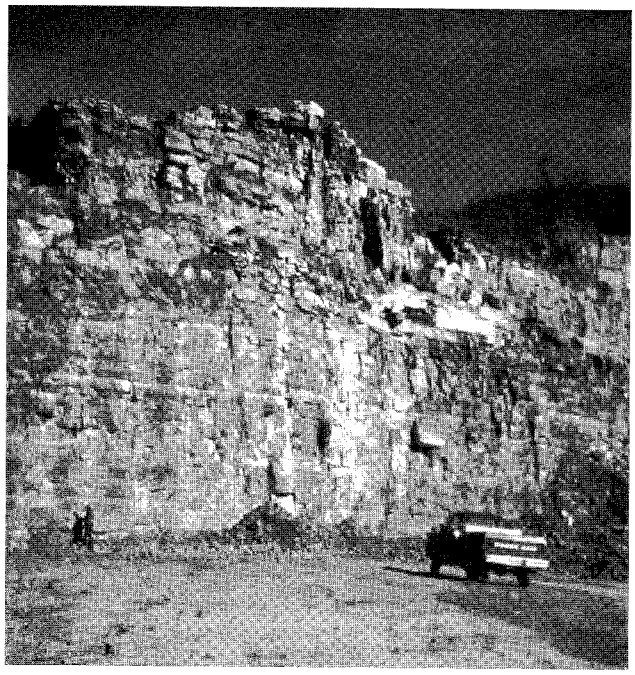


Figure 5. Carbonate rocks in quarry of Woodway Stone Company, Inc., Lee County (circa 1987).

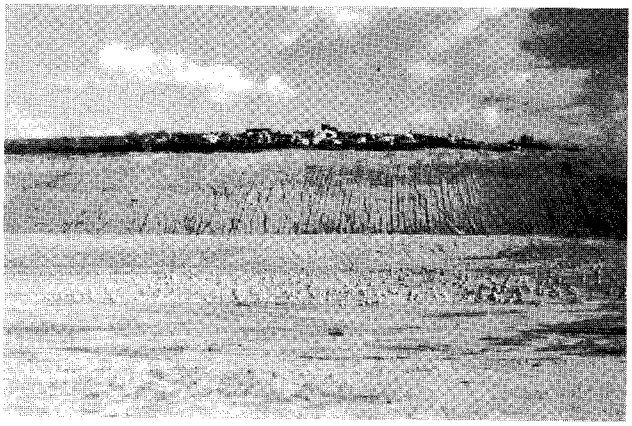


Figure 6. Landfill with one-foot of granite fines utilized as bedding for the plastic liner, Chesterfield County.

stone in the Piedmont province in 1997. Slate was the leading type of dimension stone quarried, in terms of cubic feet and value; LeSueur-Richmond Slate Corporation mines slate from two quarries in the Arvonia area of Buckingham County (Figure 7). Arvonia slate production dates from the late 1700s when slate was quarried for use as roofing shingles for the state capital in Richmond. Slate producers supply the building trade with a variety of products ranging from material for exterior applications, such as roofing shingles and granules and for flooring tile, hearths and sills. Diabase is produced by New England Stone and Virginia Black Granite in southern Culpeper County for use as monument stone and other ornamental uses. The quarried blocks are trucked to South Carolina and Georgia finishing plants; some stone is exported out of South Carolina ports to overseas markets.

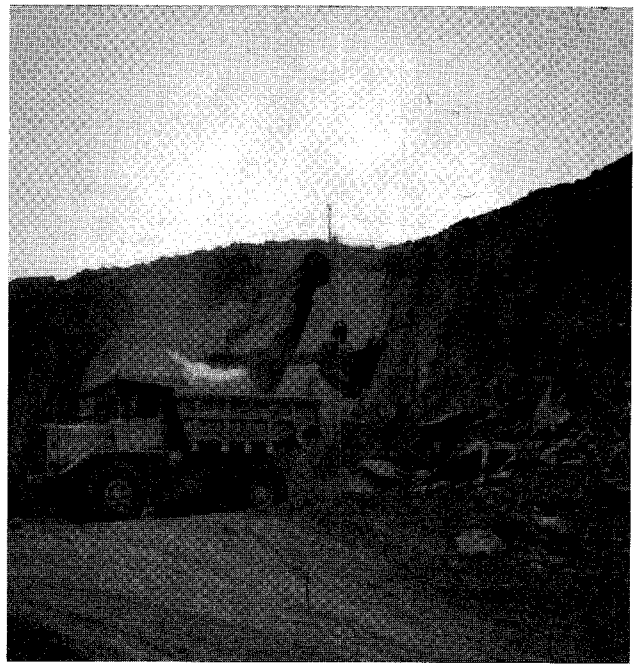


Figure 7. Mining of Arvonia Slate at LeSueur-Richmond Slate Corporation, Buckingham County.

Quartzite used as flagging material was extracted from the Mower Quarry in Fauquier County, north of Warrenton.

The soapstone plant of Tulikivi, Inc. in Schuyler, Nelson County, produces architectural stone by special order. A sales office in Charlottesville continues to take domestic orders for stoves that are manufactured in Finland.

FELDSPAR

U.S. Silica Corporation operates a mine and plant near Montpelier in Hanover County in east-central Virginia. They produce a feldspar-rich material marketed as "Virginia aplite," which is sold to the glass industry. The "aplite" improves the work-ability of the molten glass and imparts a chemical stability to the finished glassware. Medium- to coarse-grained meta-anorthosite is mined by open pit methods to produce feldspar. The rock is trucked to the plant next to the mine for crushing, grinding, classifying, and drying. After processing, the feldspar is stored in silos. Gravity concentration removes clay minerals. Electrostatic and magnetic processes remove the heavy minerals (ilmenite, rutile, and sphene) in the feldspar. These minerals contain titanium and were stockpiled until the early 1980s, but are currently being placed in setting ponds. The processed feldspar is shipped by truck and rail to markets in New Jersey, Pennsylvania, Ohio, Indiana, and Virginia.

In Amherst County, feldspar is marketed as aggregate at the Piney River Quarry of the W.W. Boxley Company, Blue Ridge Stone Corporation. The company stockpiles the fines that result from the crushing of the feldspar. In the past, feldspar was mined from several pegmatite bodies in the Piedmont province. These pegmatite bodies occur in Amelia and Bedford Counties.

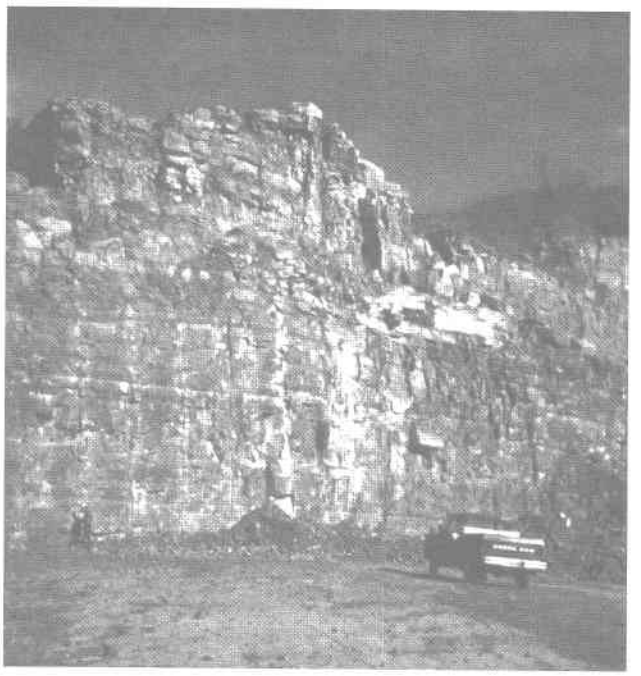
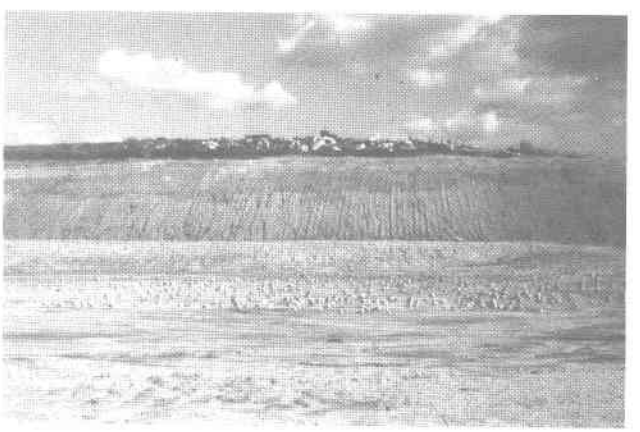


Figure 5. Carbonate rocks in quarry of Woodway Stone Company, Inc., Lee County (circa 1987).



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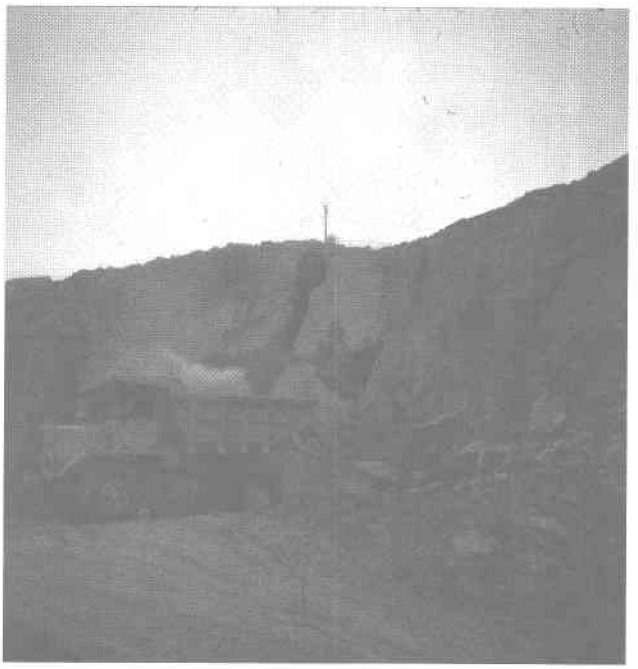

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Clay and silt, with a high percentage of kaolinite and mica, have accumulated in settling ponds at the Feldspar Corporation operation in Hanover County. About 75,000 to 100,000 tons of this material are added to settling ponds per year. The waste "tailings" were evaluated in the mid-1960s and were found suitable for use in face brick and drain tile; the material fires dark brown to gray.

GEMSTONES

In 1997, mineral collectors and mining operations in Virginia produced natural gemstones. The Morefield pegmatite, operated as the Morefield Gem Mine in Amelia County, is open to the public for collecting on a fee basis (Figure 8). Blue-green amazonstone, beryl, topaz, tantalite, tourmaline, and zircon are some minerals found in this pegmatite.

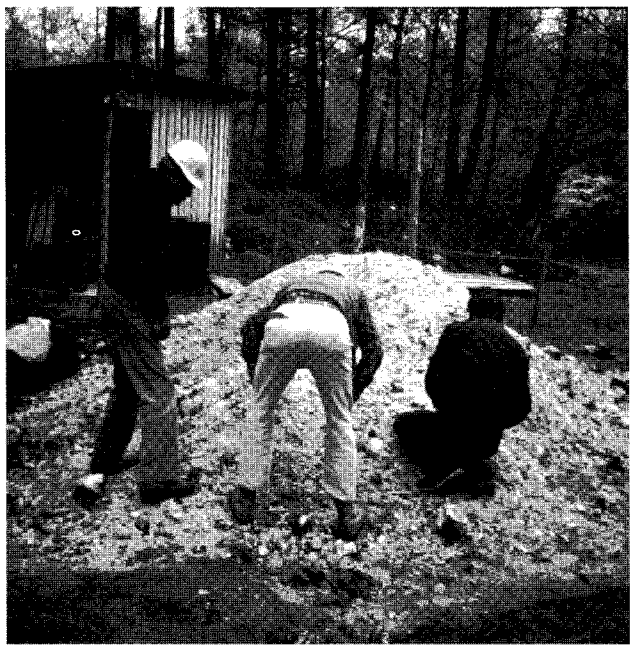

Figure 8. Dump of pegmatite material at Morefield Gem mine, Amelia County.

GYPSUM

The United States Gypsum Company operates an underground mine and mill at Locust Cove, in northeastern Smyth County in Southwest Virginia, and wallboard manufacturing facilities at Plasterco in Washington County and Norfolk in the eastern part of the state. The wallboard manufacturing facility at Plasterco has been in continuous operation since 1924 and is one of the original plants that was the foundation of United States Gypsum Company. The Locust Cove mine is a slope entry, multilevel mine that utilizes a modified room and pillar sublevel stoping mining method. The gypsum occurs as isolated boulders surrounded by gray shale and red clays in the Maccrady Formation.

After the rock is crushed to 6 inch minus underground, it is belted over a mile to the surface to a mill rock shed and stored according to rock purity. The gypsum rock is then fed into a 72 inch diameter Raymond mill and ground to 100 mesh, the resultant landplaster ($CaSO_4 + 2H_2O$) is airveyed to a coal-fired kettle that holds 50 tons of landplaster and calcined to remove the water and produce stucco. The process of producing stucco is a continuous operation where landplaster is constantly added to the kettle, heated to 300 degrees F and the combined water is driven off. The hot stucco flows into two 500-ton storage silos outside the mill.

The stucco is then transported by tanker truck 18 miles from the Locust Cove mill to the wallboard plant located at Plasterco, Virginia. At the Plasterco plant water is added to the stucco with additional ingredients (sugar, starch, and fiber) and then poured between two sheets of paper to produce wallboard. Eighty-three kinds of wallboard are produced at Plasterco; the average daily production is in excess of 1,000,000 square feet of wallboard. This is enough wallboard to supply the needs in construction of over 80 three-bedroom homes.

The Norfolk plant processes gypsum rock that is mined in Little Narrows and Windsor, Nova Scotia and transported by ocean going ships that carry 30,000 tons at a time to Norfolk. The plant in Norfolk mills the product and makes gypsum wallboard. The current capacity of the Norfolk plant is approximately 750,000 square feet of wallboard per day. In addition, the Norfolk plant grinds raw gypsum for use as fertilizer for the peanut industry and anhydrite which is used as source of sulfur in producing cement.

INDUSTRIAL SAND

Unimin Corporation produces glass sand near Gore in Frederick County. The glass sand is produced from the Ridgeley Sandstone of Devonian-age. CED Enterprises, in Frederick County, recrystallizes purchased sand in a rotary kiln to produce cristobalite (Figure 9). Cristobalite, which is sized and bagged on the site, is marketed as a fine grit, and used mainly as filler in paint and in commercial casting molds. It is trucked to the Great Lakes area and to the western United States. Some is shipped overseas through the Port of Baltimore.

IRON-OXIDE PIGMENTS

Virginia is one of four states that produce pigments from natural iron oxide. Hoover Color Corporation, in Hiwassee, Pulaski County, produces ocher, umber, and sienna. The company is the only operation in the United States producing sienna. Open pit methods are used to mine natural iron oxide from deposits. These deposits occur near the contact of the Erwin Formation with the overlying Shady Dolomite. Deposits, associated with gossans in Cambrian-age rocks, are concentrated as small bodies or pockets composed of insoluble clay and iron oxide. Precipitation from ground water also concentrates some iron oxide. The raw material is

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Figure 8. Dump of pegmatite material at Morefield Gem mine, Amelia County.

GYPSUM

The United States Gypsum Company operates an underground mine and mill at Locust Cove, in northeastern Smyth County in Southwest Virginia, and wallboard manufacturing facilities at Plasterco in Washington County and Norfolk in the eastern part of the state. The wallboard manufacturing facility at Plasterco has been in continuous operation since 1924 and is one of the original plants that was the foundation of United States Gypsum Company. The Locust Cove mine is a slope entry, multilevel mine that utilizes a modified room and pillar sublevel stoping mining method. The gypsum occurs as isolated boulders surrounded by gray shale and red clays in the Maccrady Formation.

After the rock is crushed to 6 inch minus underground, it is belted over a mile to the surface to a mill rock shed and stored according to rock purity. The gypsum rock is then fed into a 72 inch diameter Raymond mill and ground to 100 mesh, the resultant landplaster ($CaSO_4 + 2H_2O$) is airveyed to a coal-fired kettle that holds 50 tons of landplaster and calcined to remove the water and produce stucco. The process of producing stucco is a continuous operation where landplaster is constantly added to the kettle, heated to 300 degrees F and the combined water is driven off. The hot stucco flows into two 500-ton storage silos outside the mill.

The stucco is then transported by tanker truck 18 miles from the Locust Cove mill to the wallboard plant located at Plasterco, Virginia. At the Plasterco plant water is added to the stucco with additional ingredients (sugar, starch, and fiber) and then poured between two sheets of paper to produce wallboard. Eighty-three kinds of wallboard are produced at Plasterco; the average daily production is in excess of 1,000,000 square feet of wallboard. This is enough wallboard to supply the needs in construction of over 80 three-bedroom homes.

The Norfolk plant processes gypsum rock that is mined in Little Narrows and Windsor, Nova Scotia and transported by ocean going ships that carry 30,000 tons at a time to Norfolk. The plant in Norfolk mills the product and makes gypsum wallboard. The current capacity of the Norfolk plant is approximately 750,000 square feet of wallboard per day. In addition, the Norfolk plant grinds raw gypsum for use as fertilizer for the peanut industry and anhydrite which is used as source of sulfur in producing cement.

INDUSTRIAL SAND

Unimin Corporation produces glass sand near Gore in Frederick County. The glass sand is produced from the Ridgeley Sandstone of Devonian-age. CED Enterprises, in Frederick County, recrystallizes purchased sand in a rotary kiln to produce cristobalite (Figure 9). Cristobalite, which is sized and bagged on the site, is marketed as a fine grit, and used mainly as filler in paint and in commercial casting molds. It is trucked to the Great Lakes area and to the western United States. Some is shipped overseas through the Port of Baltimore.

IRON-OXIDE PIGMENTS

Virginia is one of four states that produce pigments from natural iron oxide. Hoover Color Corporation, in Hiwassee, Pulaski County, produces ocher, umber, and sienna. The company is the only operation in the United States producing sienna. Open pit methods are used to mine natural iron oxide from deposits. These deposits occur near the contact of the Erwin Formation with the overlying Shady Dolomite. Deposits, associated with gossans in Cambrian-age rocks, are concentrated as small bodies or pockets composed of insoluble clay and iron oxide. Precipitation from ground water also concentrates some iron oxide. The raw material is

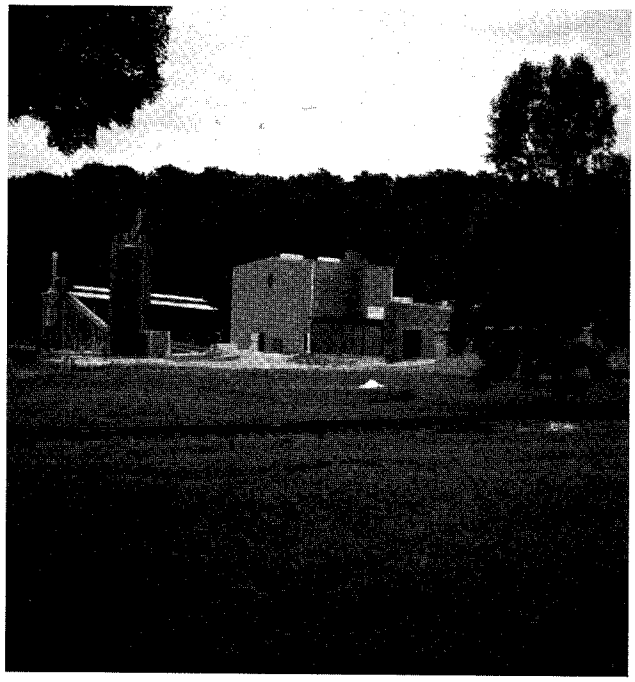


Figure 9. Processing plant of CED Enterprises, which recrystallizes high-silica sand to produce cristobalite, Frederick County.

trucked to the plant at Hiwassee where it is pulverized, dried, ground, air separated, blended, and packaged before shipping. The finished product is used as a coloring agent in a variety of products. The largest market continues to be for paint; additional markets are art supplies (crayons, chalk, water colors) and building products (colored cinder blocks and bricks). The pigments are shipped throughout the United States, Canada, and Mexico. Virginia Earth Pigments Company mines a small quantity of iron oxide from the Brubaker #1 mine in southeastern Wythe County. The Hoover Color Corporation buys most of the material.

Blue Ridge Talc Co., Inc., located in Henry County, purchases iron oxide from Cleveland-Cliffs Iron Co. in Michigan. The company dries the iron ore, pulverizes it, and sizes the material, which is marketed as a colorant for paint and cement and to the brick industry and the fertilizer industry.

KYANITE

Kyanite, an aluminum silicate, was first mined in Prince Edward County in the 1920s. Since September 1986, Virginia is the only state producing kyanite. Kyanite Mining Corporation produces most of the world's kyanite from its deposit in Buckingham County. The company produces a concentrate with a maximum of 61.8 percent alumina and a minimum iron content of 0.16 percent. The kyanite is converted to mullite by calcining at temperatures greater than 3000 degrees Fahrenheit. Mullite is a superduty refractory with a pyrometric cone equivalent of 36 to 37. Products, which are sold in 35, 48, 100, 200, and 325 mesh sizes, are used in the refractory, ceramic, glass, metallurgical, and foundry industries. Mullite aids ceramics and glass to resist cracking, warping, slagging, and deforming at high temperatures.

Kyanite Mining Corporation operates two surface mines and three processing plants in Central Buckingham County. The mines are located at Willis Mountain and at East Ridge. At the Willis Mountain and East Ridge mines, kyanite-bearing quartzite is quarried from open pits; this material is processed through primary crushers, a log washer to remove clay, onto classifiers to remove kyanite. The material then passes through a rod mill, which reduces it to a minus 35-mesh size, and through froth flotation cells where additional kyanite is skimmed off. The kyanite is dewatered and dried; the high temperature of the drier converts any sulfide minerals that are present to magnetic iron-oxides. Pyrite is converted to ferrous iron oxide (Fe_3O_4) or magnetite, which is then removed by magnetic separators and stockpiled (Figure 10).

The Willis Mountain plant processes raw kyanite, some of which is trucked to East Ridge facility for calcining; the mullite product is ground and bagged at the company's Dillwyn Plant (Figure 11). Raw kyanite is ground and bagged at Willis Mountain.

Approximately 40 percent of the production is shipped through the port at Hampton Roads to customers worldwide. Most of the mullite and kyanite shipped from the port of Norfolk is destined for Japan, Korea, United Kingdom, Netherlands, Italy, and Australia. The company also markets sandas a by-product from the processing of kyanite. This sand is used fro golf courses. masonry and concrete sand, and for applications such as sand for blasting.

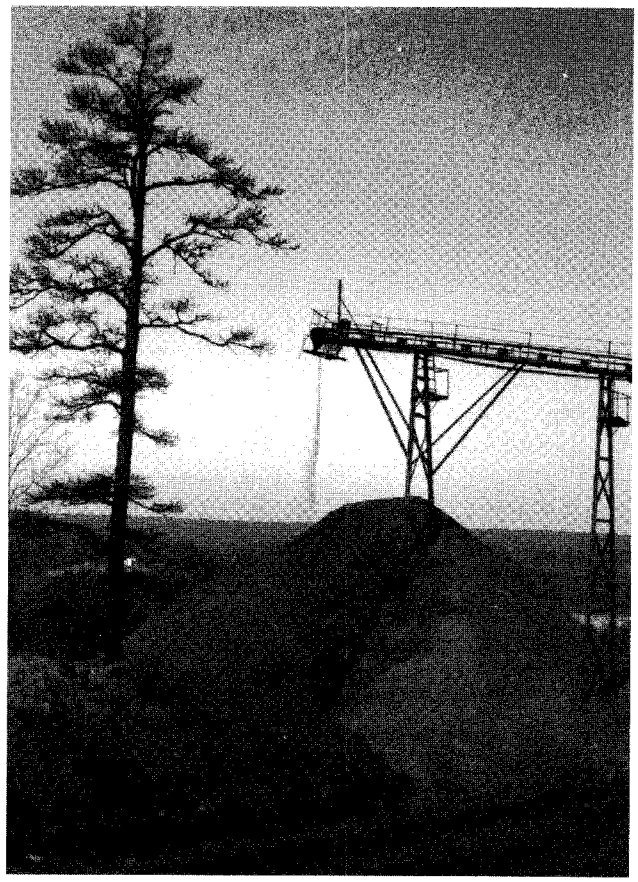
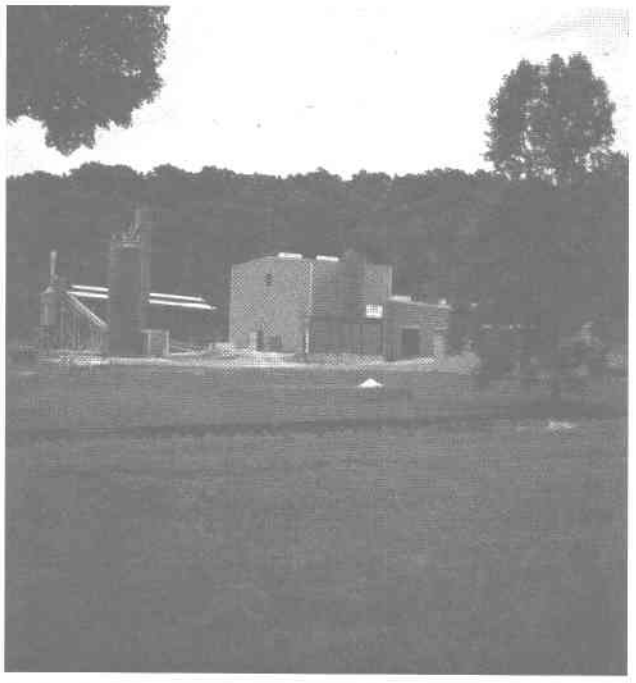


Figure 10. Stockpile of by-product magnetite, at Willis Mountain, Kyanite Mining Corporation, Buckingham County.



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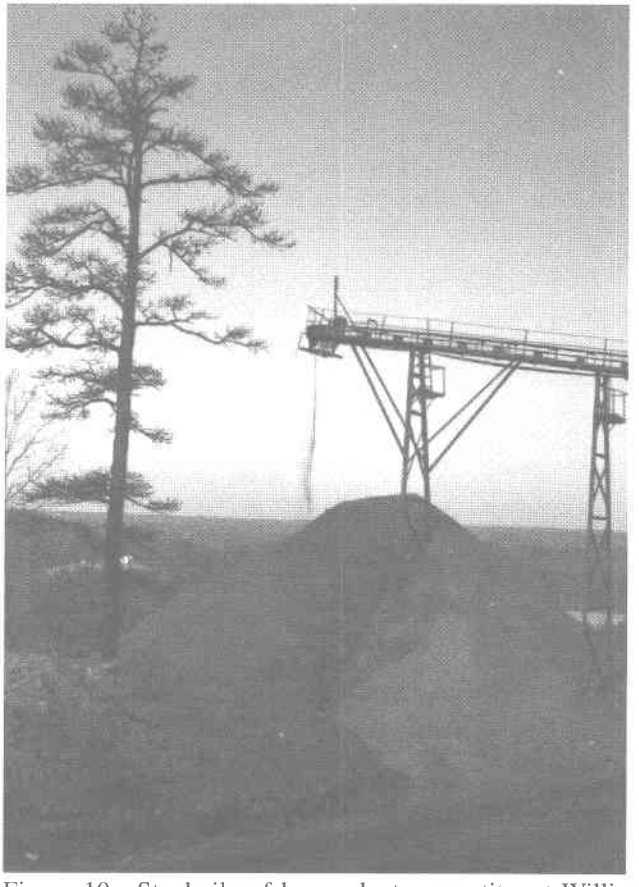

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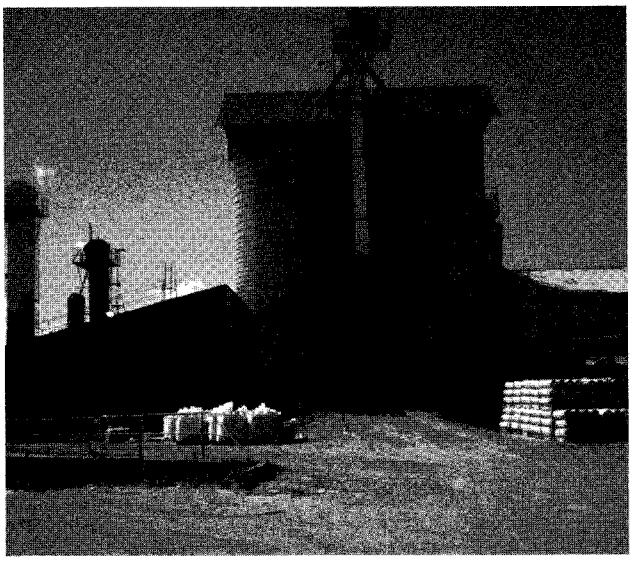

Figure 11. Mullite (calcined-kyanite) grinding and bagging plant at Dillwyn, Kyanite Mining Corporation, Buckingham County.

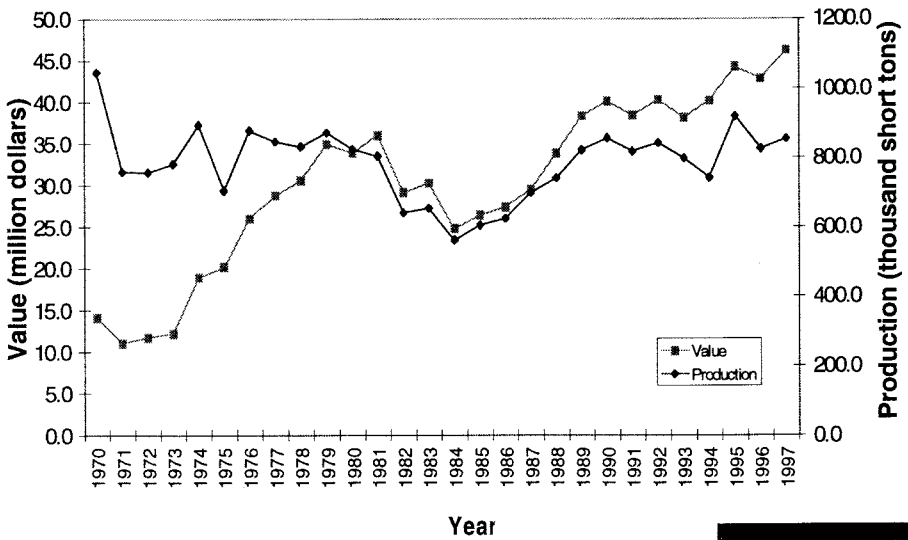

Figure 12. Trend in lime production and value, 1970-1997.

LIME

Virginia's lime production, ranked ninth in the United States, is from six companies in Frederick, Giles, Shenandoah, and Warren Counties. Production in 1997 was 853,180 short tons valued at 46.2 million dollars (Figure 12). The paper industry uses lime for regeneration of sodium hydroxide and for neutralization of sulphate water. Lime is used for water purification and in iron furnaces to remove impurities. During the last few years, lime has been used to neutralize acid mine water. It is also used for masons' lime, sewage treatment, and agriculture purposes. One most important use is to abate the SO_2 and NO_x emissions from coal-fired boilers. Lime is presently supplied to several cogeneration coal-fired plants in southern Virginia. Two companies, in northwestern Virginia, W.S. Frey Company, Inc. and Chemstone Corporation quarry and calcine the high-calcium New Market Limestone. The Riverton Corporation, in Warren County, quarries and calcines limestone from the Edinburg Formation. Shenvalley Lime Corporation in Stephens City, Frederick County buys quicklime and produces a hydrated lime. APG Lime Corporation quarries and mines underground the high-calcium Five Oaks Limestone in eastern Giles County. The limestone is calcined in rotary kilns. Principal sales are to the paper and steel industries. APG Lime Corporation also markets lime kiln dust to neutralize and stabilize coal refuse from preparation plants in West Virginia.

MANGANESE

Eveready Battery Company, Inc. operates a manganese processing facility in the City of Newport News (Figure 13). Manganese ore, imported from Ghana, Africa, and Mexico, is shipped to the Elizabeth River terminals in the City of Chesapeake. The ore is trucked to the processing plant. Manganese content and potential contaminants are monitored through continual chemical and mineralogical analysis. The manganese is dried in a gas-fired rotary kiln and crushed with jaw and ball crushers into two basic sizes. The ground product is shipped in bulk, bulk bags, or bags to plants in Iowa, Ohio, and North Carolina. The product is used in the manufacture of dry cell batteries.

MICA

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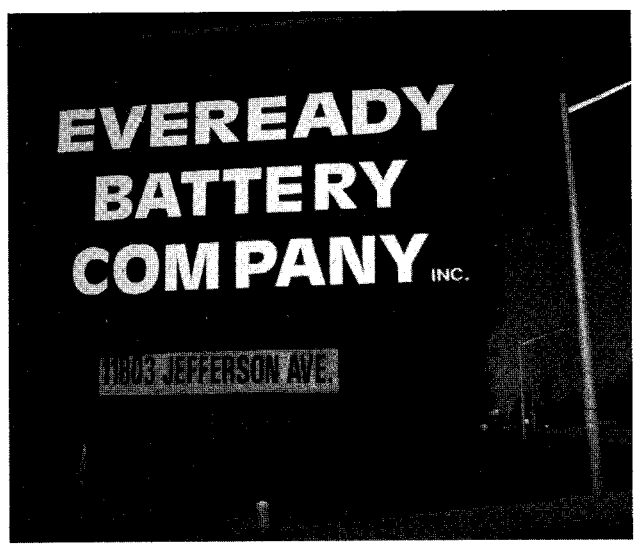
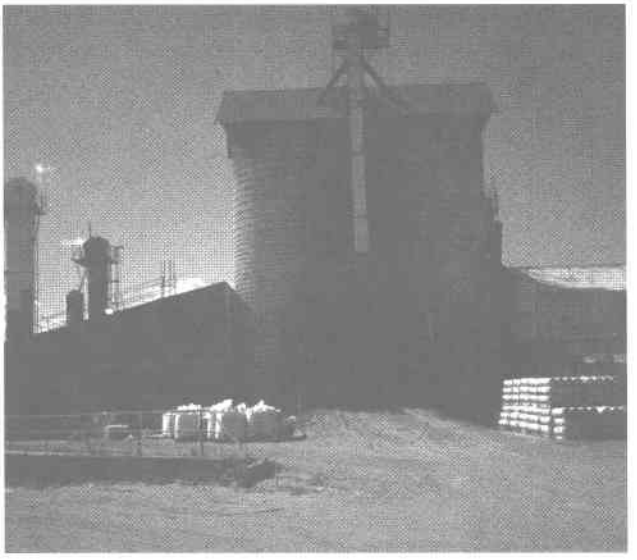


Figure 13. Manganese grinding facility of Eveready Battery Company, Inc., City of Newport News.



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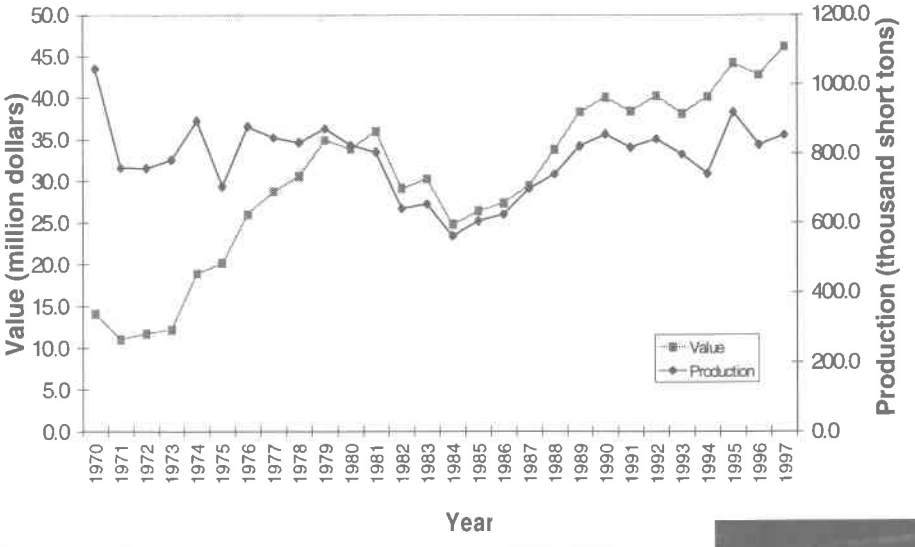

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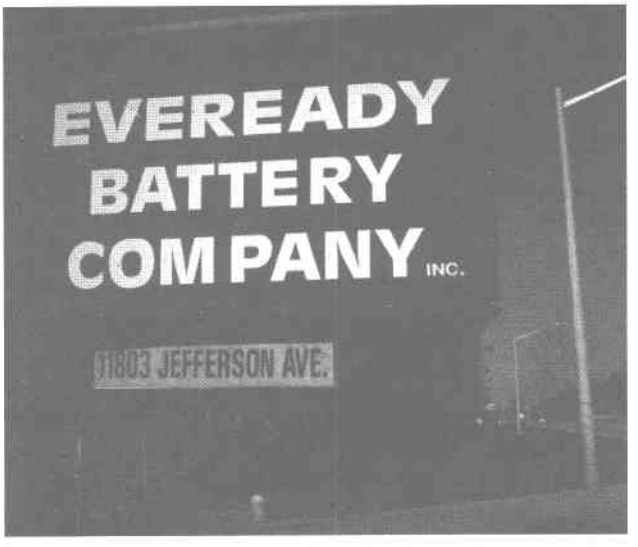

Figure 13. Manganese grinding facility of Eveready Battery Company, Inc., City of Newport News.

filiate of the Mica Company of Canada, imports several grades of crude mica from Madagascar and India, then processes the mica in Newport News. The Asheville Mica Company also produces fabricated plate mica; Mica Company of Canada uses splittings from Asheville Mica Company to produce reconstituted plate mica. Plate mica is marketed for use in hair dryers and other electrical applications; reconstituted mica, composed of built-up mica plates, is used to manufacture mica washers for terminals and as shields in lithium batteries.

MINERAL SAND

In Dinwiddie, Greensville, and Sussex Counties, more than 8.8 million short tons of heavy mineral sands have been discovered. Large acreages remain under lease by RGC (USA) Mineral Sands, Inc.-Virginia. Ilmenite, leucoxene, rutile, and zircon make up nearly 80 percent of the heavy-mineral concentrate.

RGC began production of heavy minerals in the late summer, from the Old Hickory deposit near Bolsters Store in Dinwiddie County. Concentrated material is trucked to their plant near Stony Creek in adjacent Sussex County for final processing and shipment. Production of titanium-bearing minerals during 1997 was 35,864 short tons.

ORNAMENTAL AGGREGATE

Dolostone from Botetourt County is marketed as exposed-aggregate materials. Rock materials, such as black limestone (Edinburg Formation) from the Valley and Ridge province and greenstone from the Piedmont province, have been used as aggregate for terrazzo. Exposiac Industries, Inc. in Spotsylvania County uses a variety of rock materials for exposed panels, including greenstone from Albemarle County and Triassic-age sandstone from Culpeper County.

Many rock types have been used in the past for ornamental aggregate. Vein quartz was quarried in Albemarle, Buckingham, Fauquier, Fluvanna, Greene, and Rappahannock Counties, and quartz pebbles were extracted from floodplain deposits along the Mattaponi River in Caroline County.

PERLITE

Manville Sales Corporation operates a plant at Woodstock in Shenandoah County to expand perlite (volcanic glass with high water content and "onion" skin appearance) obtained from Taos, New Mexico. Raw material is trucked north from Taos County to the railhead at Antonito, Colorado, where it is loaded and shipped by rail to Virginia. Expanded perlite is used in manufacture of roof insulation board, which is marketed throughout the eastern United States.

PHOSPHATE ROCK

PCS Phosphate (formerly Texas Gulf, Inc.) ships phosphate rock by rail from its Lee Creek operation in North Carolina to Glade Spring, Washington County. It is then transported by truck to the PCS Phosphate plant in Saltville, Smyth County. A coal-fired rotary kiln is used to defluorinate the phosphate rock. The product is marketed as poultry and animal feed supplement in southern and midwestern states.

SULFUR

Amoco Oil Company operates a crude oil refinery near Yorktown. They recover elemental sulfur from hydrogen sulfide gas during crude oil refining. During the refining process, within the fluid catalytic cracking unit, hydrogen sulfide gas is formed. The hydrogen sulfide gas is converted to elemental sulfur using the modified-Claus process. In this process the hydrogen sulfide gas is heated in a combustion chamber and fed under pressure into a cylinder where it vaporizes. The gas is then fed into a condenser where it is cooled to form a liquid. An in-line acid-gas burner reheats the total gas stream and is then fed into a catalytic converter where more hydrogen sulfide gas reacts with sulfur dioxide to produce sulfur and water vapor. Sulfur vapor is then passed through another condenser and scrubber. The elemental sulfur is marketed for production of sulfuric acid, mainly at E.I. DuPont Company in Richmond, Virginia. The sulfuric acid is then used in the manufacture of chemicals, dyes, paints, and other products.

VERMICULITE

Virginia is one of two states that mine vermiculite, a hydrated magnesium-iron-aluminum silicate. Virginia Vermiculite, Ltd. operates an open-pit mine and processing facility near Boswells Tavern in Louisa County. The vermiculite is mined with a backhoe and a front-end loader and trucked to the adjacent plant where pieces greater than four inches across are removed. These pieces are washed and processed in a rod mill to shear the vermiculite into thin platelets. Biotite, feldspar, and other impurities are further concentrated and removed by froth flotation. The vermiculite is then dewatered, dried in a kiln, and screened to produce four basic sized products. Most of the crude vermiculite is shipped by rail in unexfoliated form to North Carolina, Ohio, West Virginia, other eastern states, and North Dakota.

FUEL COMMODITIES

Mineral fuels were produced in seven southwestern Virginia counties in 1997. The combined value of all fuel commodities sold in 1997 was 1,102.58-million dollars. In 1997, 158 companies operated 237 coal-mining operations. Forty-one of the 158 companies produced coal from 119 operations. Coal production for 1997 was 36,889,166 short tons. The value of coal produced in 1997 was 959.12-million dollars.

In 1997, 9 companies operated 62 oil wells and 19 companies operated 2,018 gas wells. Oil production for 1997 was 10,337.07 barrels. Natural gas production during 1997 amounted to 58,246,751 Mcf. The value of oil produced in 1997 was 166,000 dollars and natural gas was 143.29-million dollars.

COAL

Coal production in Virginia increased from 36.7-million short tons in 1996 to 36.9-million short tons in 1997 a 0.5 percent increase (Table 1; Figure 14). Forty coal beds were mined in the southwest Virginia coalfield in 1997. These coals occur in the Appalachian Plateaus province. The coals are contained in the Pennsylvanian-age Wise, Norton, Norton-Lee-New River, and Pocahontas Formations. The highest stratigraphically mined coal bed was the High Splint of the Wise Formation (82,782 short tons) in western Wise County (Table 5). Coal mined from the Wise Formation accounted for 40.82 percent. The Norton and Norton-Lee-New River coal mined accounted for 37.80 percent. Coal mined from the Pocahontas Formation accounted for 21.38 percent. The Pocahontas No. 3 coal was the most extensively mined bed, followed by the Jawbone, Splash Dam, Low Splint, and Norton coal beds. Coal produced from these five beds constituted 47.1 percent of the total 1997 production. Coal was produced from 356 surface and underground mines in Buchanan, Dickenson, Lee, Russell, Tazewell, and Wise Counties (Table 6). Total production from 264 underground mines was 27,988,826 short tons and from 92 surface mines was 8,900,340 short tons. In underground mining, 71.5 percent of the coal was mined by continuous miners and 28.2 percent was produced by longwall mining; 0.3 percent of the coal was produced by conventional mining in 1997. In surface operations, 4.6 percent of the coal was auger mined, and 95.4 percent was mined by conventional surface methods. Total value was $959.12-million; estimated mine price was $25.99 per short ton.

The total average annual employment reported in 1997 was 6,781 employees; 6,534 of these were production employees (Table 7). Production employees worked an average of 220 days producing coal in 1997. The average annual wage earned by all production employees was $31,573, based on those employees for whom wages were reported. The average annual wage for surface-mine production employees was $27,266, and the average annual wage for underground production employees was $32,670. Wages earned by all employees totaled $206,296,424 in 1997.

Coal from Virginia is used for metallurgical purposes, electrical power generation (steam coal), industrial purposes, and residential heating. Most Virginia coal is exported through ports at Hampton Roads, Virginia and at Wilmington, North Carolina to overseas markets.

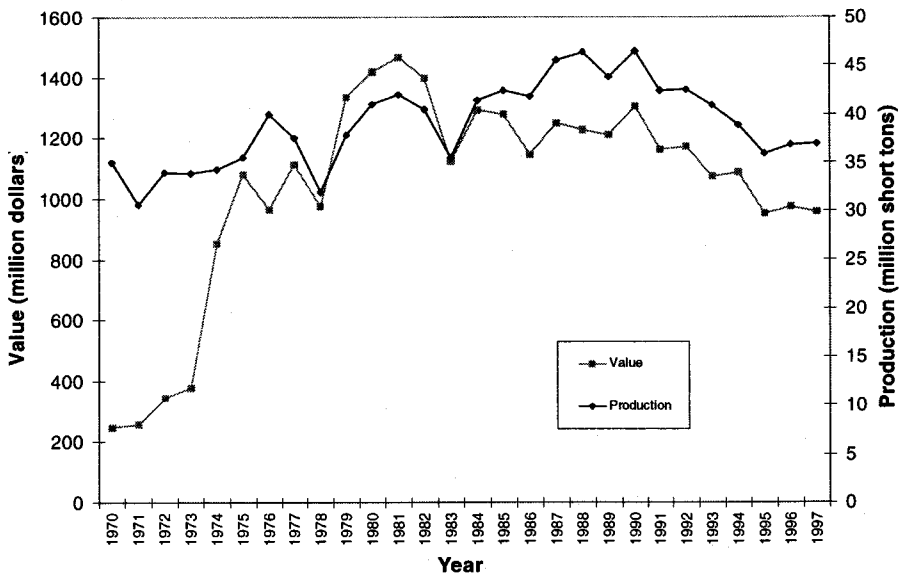

Figure 14. Trend in coal production and value, 1970-1997.

OIL AND GAS

Permitting Activity

The Department of Mines, Minerals and Energy, Division of Gas and Oil, issued 504 permits in 1997, an increase of 87.3 percent from 1996. Of these, 258 permits (Table 8) were issued to drill new coalbed methane wells, 14 for conversion of mine vertical ventilation holes to coalbed methane wells, 21 permits were for new conventional and shale gas wells, 7 for dual completion wells, 2 for facilities construction, and 26 permits were for new pipeline construction. The remaining 176 permits were for modifications (45), and transfer (131). Pocahontas Gas Partnership was issued 102 permits to drill 102 new coalbed methane wells, followed by Consol Inc. with 89 and Equitable Resources Energy Company with 66. New conventional and shale gas well permits were issued to Cabot Oil and Gas Company (11) and Equitable Resources Energy Company (10). Coalbed methane well permitting was highest in Buchanan County at 84.9 percent followed by Dickenson County at 9.2 percent and Wise County at 5.9 percent. Conventional and shale gas well permitting was highest in Tazewell County at 40.9 percent followed by Wise County at 27.3 percent.

Drilling and Completion Activity

In 1997, 298 holes were drilled in Virginia (Table 9). Of the 298 holes drilled, 13 were for conventional and shale gas, 279 were for coalbed methane, and six were for dual completion. Total footage drilled in 1997 was 672,357 feet (Table 10), a 62.8 percent increase from the 422,778 feet drilled in 1996. Of the 1997 total footage, 65,677 feet were for conventional and shale gas wells, 571,008 feet were for coalbed methane wells, 33,655 feet were for dual completion, and 2,017 feet for conversion of a vertical ventilation hole for coalbed methane production. In 1997, the average conventional and shale gas well was drilled

5052 feet and drilling depth for coalbed methane was 2054 feet. The county with the most active natural gas and coalbed methane wells drilled was Buchanan with 222, followed by Dickenson with 43, and Wise with 25. Three wells were drilled in Tazewell County, three in Russell County and two in Highland County. Two hundred and fifty-two wells were completed in 1997. Of the 252 wells completed for production 14 were for conventional and shale gas, 233 for coalbed methane, 4 for dual completion, and one waste disposal. Completion zones ranged from the Pennsylvanian Pocahontas Formation to the Mississippian-Devonian Chattanooga Shale. Location coordinates for the wells drilled or completed during 1997 can be obtained from the Division of Gas and Oil in Abingdon.

Buchanan County

Coalbed methane wells: Two Hundred and twenty coalbed methane wells were drilled in 1997. Total footage drilled in 1997 was 443,121 feet. Consol, Inc. drilled 99 development wells during 1997 with total footage of 195,986 feet; average footage drilled 1980 feet. Equitable Resources Energy Company drilled 14 development wells with a total footage of 34,628 feet; average footage drilled 2473 feet. Pocahontas Gas Partnership drilled 107 development wells with a total footage drilled of 212,507 feet; average footage drilled 1986 feet.

One hundred and seventy coalbed methane wells were completed during 1997 with a total footage of 333,456 feet; average depth 1961 feet. Additionally, one well was plugged and abandoned as a dry hole. Of these 170 wells, Consol, Inc. completed 89 development wells with a total footage of 176,100 feet; average depth of 1978 feet. Consol, Inc. also a dry hole. Equitable Resources Energy Company completed 10 coalbed methane wells with a total footage of 21,317 feet; average depth of 2132 feet. Pocahontas Gas Partnership completed 70 development wells with a total footage of 132,661 feet; average depth of 1895 feet. Completion zones in the Consol, Inc., Pocahontas Gas Partnership, and Equitable Resources Energy Co. wells are the coal beds and associated strata in the Pennsylvanian Pocahontas and Lee Formations.

Dual completion wells: Equitable Resources Energy Company drilled one well for production of coalbed methane and conventional and shale gas. Total footage drilled for this dual completion was 6,500 feet.

Dickenson County

Coalbed Methane wells: Thirty-eight coalbed methane wells were drilled and completed by Equitable Resources Energy Company in 1997 with a total footage of 86,710 feet; average depth 2282 feet. The wells were drilled into the Pennsylvanian Pocahontas Formation. All the wells are located in the Nora gas field. Gas production from the wells is by commingling of gas from coal beds and associated strata in the Pocahontas and Lee Formations.

Conventional and shale gas wells: Equitable Resources Energy Company drilled and completed three conventional and shale gas wells in 1997. All the wells are in the Nora gas field. Total footage drilled was 13,868 feet; average depth 4623 feet. All wells were drilled into the Mississippian-Devonian Chattanooga Shale. Producing formations in the two wells are the Chattanooga Shale, Berea Sandstone, and Greenbrier Limestone.

Dual completion wells: Equitable Resources Energy Company drilled and completed two wells for production of coalbed methane and conventional and shale gas. Total footage drilled for dual completions was 10,750 feet; average footage drilled 5375 feet.

Highland County

Conventional and shale gas wells: Cabot Oil and Gas Company drilled two exploratory wells during 1997. Total footage drilled was 8759 feet; average footage drilled 4380 feet. One of the wells was plugged back and abandoned as a water well. The intended-producing zone was the Ridgeley Sandstone.

Russell County

Coalbed methane wells: Equitable Resources Energy Company drilled and completed three coalbed methane wells during 1997. The wells were completed in the Skeen Creek gas field. Total footage drilled in the wells was 6891 feet with an average depth of 2297 feet. Production comes from commingling of gas associated with coal beds and associated strata in the Pocahontas and Lee Formations.

Smyth County

Waste disposal well: Virginia Gas Company drilled a 9342-foot waste disposal well in September 1996, at the Saltville Storage Project. The well is being used as an injection well for brine-fluids produced from the solution mining process of salt from the Mississippian Maccrady Formation. Fluid injection is limited to the Cloyd member of the Price Formation, interval 5610 to 5884 feet. The well was drilled into the Silurian Clinch Sandstone at total depth. The well was completed in March of 1997.

Tazewell County

Conventional and shale gas wells: Cabot Oil and Gas Company drilled and completed three development wells in the Berwind gas field in 1997. Total footage drilled was 16,235 feet; average footage drilled 5412 feet. The three wells are producing from the Mississippian Berea Sandstone bed of the Chattanooga Shale.

Wise County

Coalbed methane wells: Equitable Resources Energy Company drilled 17 coalbed methane wells in the Nora gas field in 1997. They completed sixteen of these wells. The additional well will be completed in early 1998. Total footage drilled was 42,803 feet; average depth 2518 feet. Producing zones in the seventeen wells are the coal beds and associated strata in the Pocahontas and Lee Formations.

Conventional and shale gas wells: Equitable Resources Energy Company drilled and completed five conventional and shale gas wells. Total footage drilled in the county was 26,815 feet; average depth was 5363 feet. Formation at total depth in all the wells is the Devonian-Mississippian Chattanooga Shale.

Dual completion wells: Equitable Resources Energy Company drilled and completed three wells for production of coalbed methane and conventional and shale gas. Total footage drilled was 16,405 feet; average footage drilled was 5468 feet.

Production

Crude oil production in Virginia totaled 10,337 barrels in 1997, which was a 22.6 percent decrease from the 1996 production of 13,363 barrels (Figure 15). Oil production is from the Ben Hur-Fleenortown and Rose Hill oil fields in the Valley and Ridge province and the Roaring Fork and one unnamed gas field in the Appalachian Plateaus province. Production was by nine companies from 62 wells (Table 11) in the Ben Hur-Fleenortown and Rose Hill oil fields in Lee County (5,081.16 barrels) and the Roaring Fork gas field in western Wise County (5,255.91 barrels). Sixteen wells in the Ben Hur-Fleenortown oil field yielded 3553.79 barrels of oil; average 18.51 barrels per well per month. Two wells in the Rose Hill oil field yielded 1527.37 barrels of oil. Forty-four wells in the Roaring Fork and unnamed gas field-averaged 9.95 barrels per month. Oil in Virginia comes from the Ordovician Trenton Limestone in Lee County and the Mississippian Greenbrier Limestone in Wise County. The value of oil produced in 1997 was $166,000; estimated unit value was $16.06 per barrel.

Natural gas production increased 7.3 percent, from 54,290,353 Mcf in 1996 from 1819 wells to 58,246,751 Mcf in 1997 from 2018 wells (Table 12; Figure 16). Conventional and shale gas produced was 18,167,498 Mcf from 1017 wells; 31.2 percent of the total production. Coalbed methane produced was 39,777,093 Mcf from 995 wells; 68.3 percent of the total natural gas production in the Commonwealth. Dual completion wells contributed 302,160 Mcf to the total natural gas production, 0.5 percent of the total. Average daily gas production from conventional and shale gas wells was 48.9 Mcf. Coalbed methane wells averaged 109.5 Mcf per day. Natural gas production came from Buchanan County (35,123,950 Mcf), Dickenson County (13,853,818 Mcf), Lee County (2,641 Mcf), Russell County (517,497 Mcf), Scott County (15,326 Mcf), Tazewell County (732,111 Mcf) and Wise County (7,991,440 Mcf). The average price paid to Virginia's natural gas producers in 1997 was $2.46 per Mcf. The market value for Virginia's natural gas was $143,291,927, a decrease of 15.9 percent from 1996.

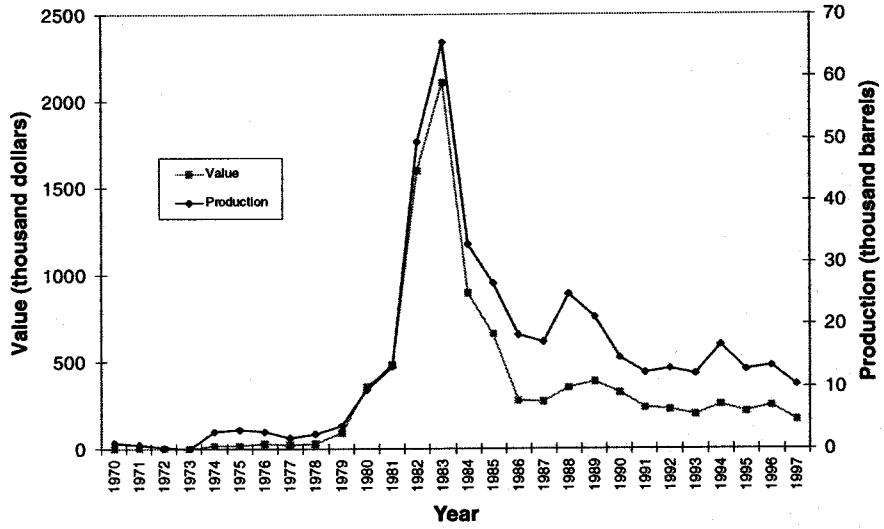

Figure 15. Trend in oil production and value, 1970-1997.

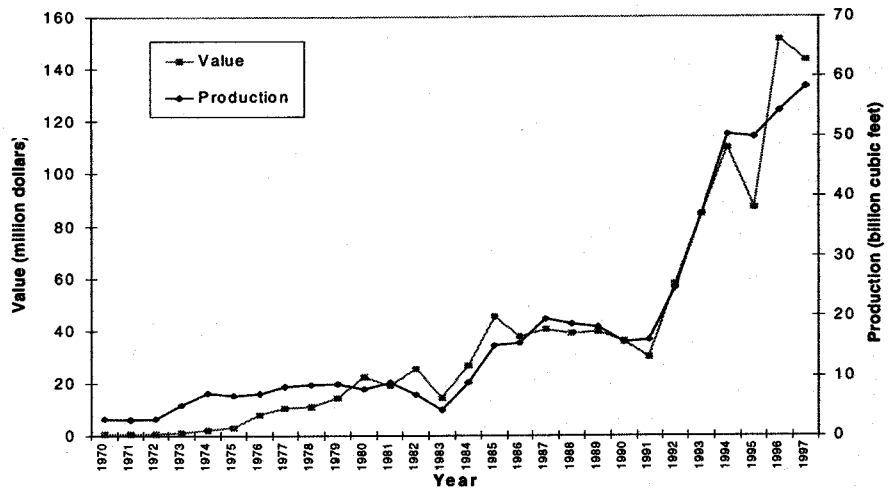

Figure 16. Trend in natural gas production and value, 1970-1997.

Table 2. Metal/nonmetal production by county/city and commodity, 1997; source Virginia Division of Mineral Mining.

County/City	Basalt and Traprock	Clay	Diabase	Diorite	Dolostone	Feldspar	Fullers Earth	Granite	Gravel	Greenstone	Gypsum
Amherst	0	0	0	0	0	408,252	0	0	0	0	0
Albemarle	958,742	0	0	0	0	0	0	384,000	0	0	0
Amherst	0	41,788	0	0	0	0	0	0	0	0	0
Botetourt	0	146,200	0	0	0	0	0	0	0	0	0
Brunswick	0	0	0	0	0	0	0	2,509,807	0	0	0
Campbell	0	0	0	0	0	0	0	0	0	516,298	0
Caroline	0	0	0	0	0	0	0	490,000	0	0	0
Chesterfield	0	373	0	0	0	0	0	1,773,700	0	0	0
Culpeper	0	0	384,366	0	0	0	0	12,439	0	0	0
Dinwiddie	0	0	0	0	0	0	0	1,036,100	0	0	0
Fairfax	2,235,875	0	0	0	0	0	0	2,247,232	0	0	0
Fauquier	767,627	0	0	0	0	0	0	675,525	0	0	0
Franklin	0	0	0	0	0	0	0	261,213	0	0	0
Goochland	0	0	0	0	0	0	0	4,836,261	0	0	0
Grayson	0	0	0	0	0	0	0	626,132	0	0	0
Greene	0	0	0	0	0	0	0	805,364	0	0	0
Greensville	0	0	0	0	0	0	0	1,497,112	0	0	0
Halifax	0	0	0	0	0	0	0	802,324	0	0	0
Hanover	0	0	0	0	0	179,383	0	0	0	0	0
Hanover	0	28,000	0	0	0	0	0	2,141,131	4,758	0	0
Henrico	0	0	0	0	0	0	0	1,098,405	21,000	0	0
Henry	0	0	0	434,785	0	0	0	687,124	0	0	0
King and Queen	0	0	0	0	0	0	57,661	0	0	0	0
King William	0	12,418	0	0	0	0	0	0	0	0	0
Loudoun	6,413,357	0	0	0	0	0	0	0	0	0	0
Louisa	0	0	0	0	0	0	0	473,998	0	0	0
Mecklenburg	0	0	0	0	0	0	0	580,904	0	0	0
Northumberland	0	0	0	0	0	0	0	0	1,800	0	0
Nottoway	0	0	0	0	0	0	0	561,582	0	0	0
Powhatan	0	0	0	0	0	0	0	935,943	0	0	0
Prince George	0	18,325	0	0	0	0	0	0	0	0	0
Prince William	3,187,675	0	0	0	0	0	0	0	0	0	0
Richmond City	0	0	0	0	0	0	0	3,201,414	0	0	0
Roanoke	0	0	0	0	1,536,206	0	0	0	0	0	0
Rockbridge	0	0	0	0	257,480	0	0	0	0	0	0
Rockingham	0	28,153	0	0	0	0	0	0	0	0	0
Smyth	0	0	0	0	0	0	0	0	0	0	323,373
Spotsylvania	0	0	0	0	0	0	0	988,000	36,780	0	0
Stafford	0	0	0	0	0	0	0	1,485,028	0	0	0
Warren	0	0	0	0	0	0	0	0	17,902	0	0
Total	13,563,276	275,257	384,366	434,785	1,793,686	587,635	57,661	30,110,738	82,240	516,298	323,373

Table 2. (continued) Metal/nonmetal production by county/city and commodity, 1997; source; Virginia Division of Mineral Mining.

County/City	Iron Oxide Pigment	Kyanite	Limestone	Quartzite	Sand	Sand and Gravel	Shale	Slate	Vermiculite
Accomack	0	0	0	0	120,827	0	0	0	0
Albemarle	0	0	0	0	0	1,200	0	0	0
Alleghany	0	0	12,811	0	0	0	0	0	0
Amelia	0	0	0	0	0	193,001	0	0	0
Amherst	0	0	0	0	6,541	0	0	0	0
Appomattox	0	0	315,263	0	0	0	0	0	0
Augusta	0	0	1,000,645	0	77,474	43,267	0	0	0
Bath	0	0		0	0	0	1,500	0	0
Bedford	0	0	1,161,358	0	28,020	12,850	0	0	0
Bland	0	0	285,413	0	0	0	0	0	0
Botetourt	0	0	1,713,635	0	0	0	0	0	0
Brunswick	0	0	0	0	5,295	0	94,930	0	0
Buckingham	0	782,715	0	0	0	0	0	337,431	0
Campbell	0	0	1,313,199	0	33,029	0	0	0	0
Caroline	0	0	0	0	0	826,658	0	0	0
Charles City	0	0	0	0	4	561,779	0	0	0
Charlotte	0	0	0	0	27,747	0	0	0	0
Cheaspeake (City)	0	0	0	0	562,151	0	0	0	0
Chesterfield	0	0	0	0	16,000	0	187	0	0
Clarke	0	0	211,532	0	0	0	560	0	0
Craig	0	0	0	0	140,986	0	0	0	0
Danville(City)	0	0	0	0	52,289	0	0	0	0
Essex	0	0	0	0	0	6,000	0	0	0
Fluvanna	0	0	0	0	3,664	0	0	0	0
Franklin	0	0	0	0	1,000	0	0	0	0
Frederick	0	0	2,030,835	400,871	2,018	0	53,234	0	0
Giles	0	0	1,240,881	0	0	0	0	0	0
Gloucester	0	0	0	0	33,603	337,045	0	0	0
Grayson	0	0	0	0	8,083	0	0	0	0
Greensville	0	0	0	0	0	205,236	94,930	0	0
Halifax	0	0	0	0	17,459	0	0	0	0
Hampton (City)	0	0	0	0	37,755	0	0	0	0
Hanover	0	0	0	0	35,928	122,462	0	0	0
Henrico	0	0	0	0	5,200	2,573,482	0	0	0
Henry	0	0	0	0	3,000	0	0	0	0
Highland	0	0	33,381	0	0	0	0	0	0
Isle Of Wight	0	0	0	0	131,190	0	0	0	0
James City	0	0	0	0	214,551	0	0	0	0

Table 2. (continued) Metal/nonmetal production by county/city and commodity, 1997; source: Virginia Division of Mineral Mining.

County/City	Iron Oxide Pigment	Kyanite	Limestone	Quartzite	Sand	Sand and Gravel	Shale	Slate	Vermiculite
King and Queen	0	0	0	0	6,000	750	0	0	0
King George	0	0	0	0	0	1,128,985	0	0	0
King William	0	0	0	0	1,891	860,140	0	0	0
Lancaster	0	0	0	0	11,710	22,823	0	0	0
Lee	0	0	911,164	0	0	0	0	0	0
Louisa	0	0	0	0	0	0	0	0	46,578
Mathews	0	0	0	0	5,600	16,861	0	0	0
Mecklenburg	0	0	0	0	450	0	0	0	0
Middlesex	0	0	0	0	84,467	0	0	0	0
Montgomery	0	0	1,742,963	0	0	0	1,200	0	0
Nelson	0	0	0	0	0	7,250	0	0	0
New Kent	0	0	0	0	0	372,952	0	0	0
Northampton	0	0	0	0	60,880	0	0	0	0
Northumberland	0	0	0	0	7,482	10	0	0	0
Orange	0	0	0	0	0	0	87,044	0	0
Page	0	0	0	0	0	0	700	0	0
Pittsylvania	0	0	0	0	63,181	0	0	233,670	0
Prince George	0	0	0	0	0	1,418,900	0	0	0
Prince William	0	0	0	0	0	0	102,665	0	0
Pulaski	0	0	496,196	0	0	0	0	0	0
Richmond	0	0	0	0	2,440	0	0	0	0
Roanoke	0	0	0	0	0	0	68,020	0	0
Rockbridge	0	0	332,233	0	0	0	0	0	0
Rockingham	0	0	1,601,929	0	0	279,577	61,743	0	0
Russell	0	0	1,470,449	0	0	0	0	0	0
Scott	0	0	519,450	0	0	0	0	0	0
Shenandoah	0	0	2,775,600	0	750	0	2,233	0	0
Smyth	0	0	78,832	0	9,250	0	0	0	0
Southampton	0	0	0	0	222,583	4,677,508	0	0	0
Spotsylvania	0	0	0	0	0	622,900	0	0	0
Stafford	0	0	0	0	0	535,227	0	0	0
Suffolk (City)	0	0	0	0	255,963	74,348	0	0	0
Surry	0	0	0	0	2,000	150,000	0	0	0
Sussex	0	0	0	0	0	65,809	0	0	0
Tazewell	0	0	1,238,981	0	0	0	0	0	0
Virginia Beach(City)	0	0	0	0	1,580,278	0	0	0	0
Warren	0	0	465,073	0	0	0	0	0	0
Washington	0	0	850,366	0	0	0	0	0	0
Westmoreland	0	0	0	0	84,324	7,015	0	0	0
Wise	0	0	450,939	0	0	0	0	0	0
Wythe	400	0	712,031	790,843	150,440	0	152,314	0	0
York	0	0	0	0	6,783	0	0		0
Total	400	782,715	22,965,159	1,191,714	4,120,286	15,124,035	721,260	571,101	46,578

Table 3. Metal/nonmetal mining by commodity, 1997; source: Virginia Division of Mineral Mining.

Commodity	Annual Tonnage	Office Workers	Office Hours	Office Wages	Plant Workers	Quarry Workers	Production Hours	Production Wages
Basalt/Traprock	13,563,276.00	44	99,496	$2,074,700	184	97	718,492	$10,344,279
Clay	275,257.00	29	24,164	$525,092	81	36	103,966	$1,302,687
Diabase	384,366.49	2	3,506	$44,099	1	34	55,535	$607,486
Diorite	434,785.00	7	13,107	$257,865	35	8	66,251	$700,163
Dolostone	1,793,686.00	15	30,379	$956,069	35	29	135,276	$1,722,494
Feldspar	587,635.00	8	16,818	$355,152	31	8	105,450	$1,296,079
Fullers Earth	57,661.00	7	12,480	$223,865	60	2	85,542	$900,376
Gemstones	44.00	2	60	$75	0	1	215	$161
Gold	0.00	3	70	$700	3	3	715	$7,250
Granite	30,110,738.01	74	183,809	$2,956,117	388	292	1,725,321	$24,771,529
Gravel	82,240.00	6	110	$1,120	0	19	2,139	$45,351
Greenstone	516,298.00	4	8,813	$155,816	5	6	28,416	$315,106
Gypsum	323,373.00	9	19,588	$368,188	65	0	153,744	$1,712,047
Iron Oxide Pigments	400.00	1	4	$40	0	4	338	$31,320
Kyanite	782,715.00	24	41,003	$2,102,165	120	30	306,628	$4,137,726
Limestone	22,965,158.98	240	483,208	$8,228,596	776	501	2,634,869	$35,482,351
Limonite	273.00	16	23,520	$599,139	37	0	62,950	$550,579
Marl	10,230.00	1	974	$18,262	0	1	913	$11,601
Quartz	4,352.00	1	2	$31	1	1	821	$8,193
Quartzite	1,191,714.00	5	11,142	$165,684	42	8	105,814	$1,359,524
Sand	4,120,285.96	119	72,921	$1,019,099	63	219	212,001	$2,499,291
Sand and Gravel	15,124,035.28	80	103,037	$1,904,990	255	160	630,121	$9,175,472
Sandstone	845,583.00	9	21,729	$389,284	15	7	43,290	$569,184
Shale	721,260.00	11	3,326	$61,918	2	74	30,238	$489,284
Slate	571,101.00	35	70,096	$1,111,099	234	35	313,762	$2,702,305
Soapstone	300.00	2	3,120	$34,000	2	0	4,160	$29,000
Titanium	35,864.00	20	24,328	$738,072	25	19	43,968	$678,880
Vermiculite	46,578.00	5	12,400	$260,000	14	8	49,375	$588,000
Total	**94,549,209.72**	**779**	**1,283,210**	**$24,551,237**	**2,474**	**1,602**	**7,620,310**	**$102,037,718**

Table 4. Metal/nonmetal mining by county/city, 1997; source: Virginia Division of Mineral Mining.

County/City	Annual Tonnage	Office Workers	Office Hours	Office Wages	Plant Workers	Quarry Workers	Production Hours	Production Wages
Accomack	120,827.00	8	851	$2,830	3	18	5,428	$52,474
Albemarle	1,343,942.00	7	10,940	$193,603	19	12	75,648	$1,147,394
Alleghany	12,811.00	1	239	$2,535	1	3	1,211	$36,039
Amelia	193,045.00	3	2,527	$22,755	9	1	10,924	$151,610
Amherst	456,581.00	5	6,322	$126,823	10	8	37,668	$394,925
Appomattox	315,262.75	3	6,703	$121,293	11	6	35,620	$430,864
Augusta	1,382,843.94	13	27,672	$333,895	33	27	119,313	$1,405,572
Bath	1,500.00	0	0	$0	0	1	50	$525
Bedford	1,206,579.72	13	20,503	$297,335	35	17	95,035	$1,082,810
Bland	285,413.00	2	4,816	$55,996	3	7	18,838	$152,317
Botetourt	1,859,835.00	52	101,070	$2,484,747	166	39	463,975	$7,838,812
Brunswick	2,610,032.00	6	9,191	$101,896	32	44	182,921	$2,036,680
Buckingham	1,120,146.00	48	88,038	$2,772,588	320	65	546,548	$6,038,223
Campbell	1,862,526.33	17	27,292	$499,940	24	24	107,700	$1,288,159
Caroline	1,316,658.29	8	15,897	$274,698	21	10	62,998	$864,734
Charles City	561,783.00	3	2,911	$30,657	5	14	27,281	$384,337
Charlotte	27,747.00	1	52	$364	5		1,587	$14,742
Chesapeake (City)	562,151.00	14	9,560	$78,760	5	25	24,571	$245,283
Chesterfield	1,790,260.00	5	13,099	$264,480	25	16	92,903	$1,786,320
Clarke	212,092.00	2	2,463	$28,241	5	9	22,472	$242,780
Craig	140,986.00	2	2,545	$22,282	2	4	14,765	$126,317
Culpeper	821,805.49	7	19,480	$325,813	4	64	105,897	$1,378,069
Danville (City)	52,289.00	0	0	$0	0	3	6,386	$63,689
Dinwiddie	1,071,964.00	23	31,935	$902,088	40	26	99,753	$1,881,664
Essex	6,000.00	1	15	$113	0	1	64	$4,500
Fairfax	4,483,107.00	8	21,350	$254,100	46	31	213,402	$3,108,328
Fauquier	1,443,260.00	4	6,021	$89,251	18	14	88,580	$1,190,211
Fluvanna	3,663.78	0	0	$0	0	2	295	$12,727
Franklin	262,213.00	2	4	$40	7	7	25,988	$336,683
Frederick	2,486,958.00	35	61,784	$997,309	94	71	313,305	$3,882,813
Giles	1,240,881.06	13	23,361	$461,581	113	59	366,576	$5,715,975
Gloucester	370,648.00	9	6,795	$84,238	4	14	21,843	$296,108
Goochland	4,836,261.00	8	21,183	$312,558	47	32	200,388	$2,770,427
Grayson	634,215.03	5	6,296	$52,619	21	15	71,502	$682,762
Greene	805,364.00	2	4,800	$70,270	11	7	47,442	$566,619
Greensville	1,797,278.00	4	6,602	$71,065	26	32	134,421	$1,577,525
Halifax	819,783.16	2	6,741	$77,024	14	11	59,947	$742,300
Hampton (City)	37,755.00	1	1,294	$21,254	0	1	1,263	$12,819
Hanover	2,511,662.00	15	22,101	$435,290	59	41	192,340	$3,055,096
Henrico	3,698,087.00	17	35,162	$739,302	46	35	174,834	$2,735,857
Henry	1,124,909.00	14	26,204	$570,422	50	16	115,215	$1,253,734
Highland	33,381.00	2	2,653	$34,623	3	4	8,583	$73,007
Isle of Wight	141,420.00	9	17,961	$273,905	4	10	19,367	$326,266
James City	214,551.00	1	30	$600	0	6	5,298	$56,817
King and Queen	64,411.00	17	12,495	$224,015	60	6	86,142	$907,476
King George	1,128,985.00	8	8,199	$153,979	40	23	55,060	$639,064
King William	874,448.74	35	33,252	$803,349	124	25	163,150	$2,245,792
Lancaster	34,533.25	6	44	$419	17	12	5,195	$28,133
Lee	920,664.42	10	11,664	$143,052	15	32	76,607	$891,592
Loudoun	6,413,357.00	34	76,914	$1,788,861	99	57	361,243	$5,358,778
Louisa	520,575.92	6	14,800	$289,177	26	14	83,029	$967,350
Mathews	22,461.00	1	10	$100	0	3	790	$5,340
Mecklenburg	581,354.00	3	5,440	$48,316	10	10	56,618	$575,213

Table 4. (continued) Metal/nonmetal mining by county/city, 1997; source: Virginia Division of Mineral Mining.

County/City	Annual Tonnage	Office Workers	Office Hours	Office Wages	Plant Workers	Quarry Workers	Production Hours	Production Wages
Middlesex	84,467.00	7	143	$3,758	2	10	4,510	$49,753
Montgomery	1,744,163.00	9	40,074	$177,514	30	22	90,218	$1,274,471
Nelson	7,550.00	4	3,125	$34,080	4	4	4,366	$32,858
New Kent	372,952.00	4	5,274	$121,114	8	7	19,874	$222,316
Northampton	60,880.00	1	1,500	$15,000	0	8	3,198	$25,776
Northumberland	9,292.00	2	12	$48	1	9	2,983	$18,648
Nottoway	561,582.00	2	4,800	$53,215	11	7	30,228	$522,343
Orange	87,044.00	2	2,880	$50,548	0	1	1,440	$14,461
Page	700.00	0	0	$0	0	4	90	$700
Pittsylvania	296,851.11	18	24,002	$445,233	31	12	62,467	$662,574
Powhatan	935,943.00	1	2,400	$27,242	8	6	33,465	$454,244
Prince Edward	0.00	1	1,461	$16,513	9	0	23,365	$301,306
Prince George	1,437,225.00	3	7,578	$140,768	22	13	87,576	$1,623,360
Prince William	3,290,340.00	4	6,198	$78,912	47	20	186,077	$2,862,403
Pulaski	496,468.84	20	29,412	$654,938	44	13	105,681	$991,490
Richmond (City)	3,203,854.00	9	16,744	$306,541	32	22	128,667	$2,209,561
Roanoke	1,604,226.00	12	23,920	$880,993	30	24	118,919	$1,596,097
Rockbridge	589,713.00	5	7,516	$94,712	7	22	52,528	$427,949
Rockingham	1,971,402.00	19	27,166	$338,066	42	58	143,877	$1,666,090
Russell	1,470,449.00	19	27,065	$401,439	72	37	167,781	$1,562,701
Scott	519,450.00	7	12,943	$219,174	0	14	25,331	$232,022
Shenandoah	2,778,583.00	14	28,721	$781,178	76	35	224,731	$3,569,975
Smyth	411,454.81	9	19,588	$368,188	69	3	167,198	$1,823,517
Southampton	4,900,090.73	6	7,604	$99,555	6	12	12,303	$138,763
Spotsylvania	1,647,680.00	8	11,938	$223,755	30	24	111,941	$1,947,172
Stafford	2,020,255.00	5	10,482	$127,505	23	15	104,032	$1,476,770
Suffolk (City)	330,311.45	4	1,701	$9,974	0	6	6,045	$60,932
Surry	152,000.00	0	0	$0	0	2	32	$345
Sussex	65,809.00	2	604	$3,040	0	6	11,788	$106,045
Tazewell	1,238,981.00	10	22,482	$376,218	28	28	121,794	$1,556,948
Virginia Beach (City)	1,580,277.72	13	19,115	$418,314	3	29	31,475	$463,241
Warren	482,975.00	18	34,514	$690,118	36	21	124,786	$1,808,868
Washington	850,366.16	3	8,168	$75,373	4	18	52,818	$654,157
Westmoreland	91,339.02	3	2,705	$19,709	0	7	3,241	$79,521
Wise	450,939.00	2	3,207	$31,181	0	14	29,393	$418,873
Wythe	1,955,545.00	17	30,388	$323,377	67	34	217,115	$2,107,833
York	6,783.00	1	499	$3,493	0	1	998	$9,984
Total	94,549,209.72	779	1,283,210	$24,551,237	2,474	1,602	7,620,310	$102,037,718

Table 5. Coal production in Virginia by county and coal bed, 1997; source Virginia Division of Mines.

Formation/Coal bed	**Buchanan**	**Dickenson**	**Lee**	**Russell**	**Tazewell**	**Wise**	**Total**
Wise	**1,454,488**	**570,484**	**1,548,812**	**0**	**0**	**11,486,042**	**15,059,826**
High Splint	0	0	0	0	0	82,782	82,782
Morris	0	0	0	0	0	65,882	65,882
Pardee(Parsons)	0	0	0	0	0	399,396	399,396
Wax	0	0	0	0	0	26,506	26,506
Phillips/Wallins Creek	0	0	680,237	0	0	419,882	1,100,119
Little Red	0	0	0	0	0	52,379	52,379
House	0	0	0	0	0	173,334	173,334
Low Splint	0	0	0	0	0	2,087,202	2,087,202
34 inch (Cedar Grove)	0	0	0	0	0	107,560	107,560
Owl	0	0	0	0	0	79,423	79,423
Taggart/Darby	0	0	23,647	0	0	689,825	713,472
Taggart Marker/Kellioka	0	0	170,321	0	0	45,563	215,884
Wilson/Harlan/Standiford	0	0	234,065	0	0	433,911	667,976
Upper St. Charles	0	0	0	0	0	897,165	897,165
Pinhook	0	0	0	0	0	150,581	150,581
Kelly	0	0	46,199	0	0	1,512,468	1,558,667
Imboden/Upper Mason/ Campbell Creek	51,557	0	394,343	0	0	886,738	1,332,638
Clintwood	8,447	315,069	0	0	0	790,172	1,113,688
Lower Clintwood	0	88,876	0	0	0	0	88,876
Blair	750,374	0	0	0	0	689,153	1,439,527
Blair Marker	0	0	0	0	0	19,403	19,403
Lyons/Eagle	612,325	0	0	0	0	608,583	1,220,908
Dorchester	31,785	166,539	0	0	0	1,268,134	1,466,458
Norton	**2,496,079**	**2,363,884**	**0**	**514,963**	**0**	**2,052,570**	**7,427,496**
Norton	0	336,684	0	0	0	1,661,934	1,998,618
Hagy	359,285	37,531	0	0	0	0	396,816
Splash Dam	1,910,456	282,778	0	484	0	0	2,193,718
Upper Banner	0	761,494	0	243,632	0	390,636	1,395,762
Lower Banner	0	945,397	0	1,317	0	0	946,714
Kennedy	226,338	0	0	269,530	0	0	495,868
Norton/New River	**2,139,505**	**425,797**	**0**	**494,065**	**2,285,455**	**1,172,261**	**6,517,083**
Aily	0	0	0	0	0	12,451	12,451
Raven/Red Ash	936,491	63,094	0	0	105,899	51,240	1,156,724
Jawbone	1,203,014	362,703	0	494,065	41,508	1,108,570	3,209,860
Tiller	0	0	0	0	455,534	0	455,534
Greasy Creek	0	0	0	0	83,848	0	83,848
Lower Seaboard	0	0	0	0	588,130	0	588,130
Upper Horsepen	0	0	0	0	760,526	0	760,526
War Creek	0	0	0	0	3,382	0	3,382
Lower Horsepen	0	0	0	0	110,785	0	110,785
Pocahontas No. 8	0	0	0	0	135,843	0	135,843
Pocahontas	**7,884,760**	0	0	0	0	0	**7,884,760**
Pocahontas No. 3	7,884,760	0	0	0	0	0	7,884,760
Total	**13,974,832**	**3,360,165**	**1,548,812**	**1,009,028**	**2,285,455**	**14,710,873**	**36,889,165**

Table 6. Coal mine production (short tons) in Virginia by county and mining method, 1997; source: Virginia Division of Mines.

	Buchanan	Dickenson	Lee	Russell	Scott	Tazewell	Wise	Total
Number of Mines								
Auger	9	6	4	1	0	0	11	31
Strip	11	13	4	5	0	0	28	61
Surface Total	20	19	8	6	0	0	39	92
Undg. total	123	24	15	9	0	35	58	264
Total	**143**	**43**	**23**	**15**	**0**	**35**	**97**	**356**
Tonnages								
Auger	23,615	46,270	34,007	4,199	0	0	297,608	405,698
Strip	974,615	1,206,756	217,442	237,421	0	0	5,858,587	8,494,642
Surface Total	998,230	1,253,026	251,449	241,440	0	0	6,156,195	8,900,340
Undg. total	12,976,600	2,107,139	1,297,364	767,590	0	2,285,455	8,554,679	27,988,826
Total	**13,974,830**	**3,360,165**	**1,548,813**	**1,009,030**	**0**	**2,285,455**	**14,710,874**	**36,889,166**
Mining Method (tonnage)								
Underground								
Longwall	7,884,760	0	0	0	0	0	0	7,884,760
Continuous miner	5,083,122	2,044,045	1,297,364	767,590	0	2,284,614	8,535,817	20,012,552
Other	8,718	63,094	0	0	0	841	18,861	91,514
Undg. total	**12,976,600**	**2,107,139**	**1,297,364**	**767,590**	**0**	**2,285,455**	**8,554,678**	**27,988,826**
Surface								
Auger	23,615	46,270	34,007	4,199	0	0	297,608	405,698
Strip	974,615	1,206,756	217,442	237,241	0	0	5,858,587	8,494,642
Surface total	998,230	1,253,026	251,449	241,440	0	0	6,156,195	8,900,340
Total	**13,974,831**	**360,165**	**1,548,813**	**1,009,029**	**0**	**2,285,455**	**14,710,874**	**36,889,166**

Table 7. Coal mine employment in Virginia by county and mining method, 1997; source: Virginia Division of Mines.

	Buchanan	Dickenson	Lee	Russell	Tazewell	Wise	Total
Prod. Employees							
Auger	30	14	21	4	0	25	94
Strip	137	205	126	93	0	678	1,239
Surface Total	167	219	147	97	0	703	1,333
Undg. total	2,083	516	286	153	506	1,657	5,201
Total	**2,250**	**735**	**433**	**250**	**506**	**2,360**	**6,534**
Man days							
Auger	1,466	444	576	420	0	1,704	4,610
Strip	2,580	3,170	480	254	0	8,620	15,104
Surface Total	4,046	3,614	1,056	674	0	10,324	19,714
Undg. total	26,264	6,850	2,652	2,446	10,462	15,810	64,484
Total	**30,310**	**10,464**	**3,708**	**3,120**	**10,462**	**26,134**	**84,198**
Man Hours							
Auger	19,563	9,091	7,223	840	0	67,115	103,832
Strip	262,784	303,606	67,730	64,695	0	1,445,848	2,144,663
Surface Total	282,347	312,697	74,953	65,535	0	1,512,963	2,248,495
Undg. total	4,097,089	887,282	481,689	271,798	721,439	2,784,031	9,243,328
Total	**4,379,436**	**1,199,979**	**556,642**	**337,333**	**721,439**	**4,296,994**	**11,491,823**
Prod. Wages							
Auger	197,646	88,804	33,621	6,720	0	667,400	994,191
Strip	4,611,796	6,498,371	811,601	1,525,424	0	21,904,007	35,351,199
Surface Total	4,809,442	6,587,175	845,222	1,532,144	0	22,571,407	36,345,390
Undg. total	81,933,573	16,355,092	9,393,717	5,574,926	12,506,034	44,187,692	169,951,034
Total	**86,743,015**	**22,942,267**	**10,238,939**	**7,107,070**	**12,506,034**	**66,759,099**	**206,296,424**
Office Employees							
Auger	1	2	0	1	0	0	4
Strip	1	2	4	3	0	54	64
Surface Total	2	4	4	4	0	54	68
Undg. total	92	5	6	2	26	48	179
Total	**94**	**9**	**10**	**6**	**26**	**102**	**247**
Office Wages							
Auger	1,710	800	0	1,050	0	0	3,560
Strip	21,400	9,933	51,660	14,880	0	2,161,813	2,259,686
Surface Total	23,110	10,733	51,660	15,930	0	2,161,813	2,263,246
Undg. total	4,233,204	47,325	510,420	306,850	688,364	1,808,273	7,594,436
Total	**4,256,314**	**58,058**	**562,080**	**322,780**	**688,364**	**3,970,086**	**9,857,682**

Table 8. New permits issued by category, 1997; source: Virginia Division of Gas and Oil.

County/ Operator	Coalbed Methane	Coalbed Converison	Gas	Gas/Coalbed Methane	Facilities	Pipeline	Total
Buchanan	**216**	**14**	**0**	**1**	**0**	**8**	**239**
Consol Inc.	89	14	0	0	0	0	103
Equitable	25	0	0	1	0	8	34
Pocahontas Gas	102	0	0	0	0	0	102
Chesterfield	**1**	**0**	**0**	**0**	**0**	**0**	**1**
Evan Energy	1	0	0	0	0	0	1
Dickenson	**25**	**0**	**4**	**3**	**0**	**10**	**42**
Equitable	25	0	4	3	0	10	42
Highland	**0**	**0**	**2**	**0**	**0**	**0**	**2**
Cabot Oil & Gas	0	0	2	0	0	0	2
Tazewell	**0**	**0**	**9**	**0**	**0**	**1**	**10**
Cabot Oil & Gas	0	0	9	0	0	1	10
Wise	**16**	**0**	**6**	**3**	**2**	**7**	**34**
Equitable	16	0	6	3	2	7	34
Total	**258**	**14**	**21**	**7**	**2**	**26**	**328**

Table 9. Drilling and completion activity by well type and county, 1997; source: Virginia Division of Gas and Oil.

County	Wells Drilled				Wells Completed					Wells Plugged		
	Gas	Coal-bed Methane	Dual Completion	Total	Gas	Coal-bed Methane	Dual Completion	Waste Disposal	Total Methane	Gas	Coal-bed	Total
Buchanan	**0**	**221**	**1**	**222**	**0**	**174**	**0**	**0**	**174**	**0**	**1**	**1**
Consol Inc	0	99	0	99	0	92	0	0	92	0	1	1
Equitable	0	14	1	15	0	10	0	0	10	0	0	0
Pocahontas	0	108	0	108	0	72	0	0	72	0	0	0
Dickenson	**3**	**38**	**2**	**43**	**4**	**40**	**2**	**0**	**46**	**0**	**0**	**0**
Equitable	3	28	2	43	4	40	2	0	46	0	0	0
Highland	**2**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**
Cabot Oil & Gas	2	0	0	2	0	0	0	0	0	1	0	1
Russell	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**0**	**3**	**0**	**0**	**0**
Equitable	0	3	0	3	0	3	0	0	3	0	0	0
Smyth	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**0**
Virginia Gas	0	0	0	0	0	0	0	1	1	0	0	0
Tazewell	**3**	**0**	**0**	**3**	**3**	**0**	**0**	**0**	**3**	**0**	**0**	**0**
Cabot Oil & Gas	3	0	0	3	3	0	0	0	3	0	0	0
Wise	**5**	**17**	**3**	**25**	**7**	**16**	**2**	**0**	**25**	**0**	**0**	**0**
Equitable	5	17	3	25	7	16	2	0	25	0	0	0
Total	**13**	**279**	**6**	**298**	**14**	**233**	**4**	**1**	**252**	**1**	**1**	**2**

Table 10. Total footage drilled for natural gas by well type and county, 1997; source: Virginia Division of Gas and Oil.

County	Gas	Coal-bed Methane	Coalbed Conversion	Dual Completion	Total
Buchanan	0	434,604	2,017	6,500	443,121
Dickenson	13,868	86,710	0	10,750	111,328
Highland	8,759	0	0	0	8,759
Russell	0	6,891	0	0	6,891
Tazewell	16,235	0	0	0	16,235
Wise	26,815	42,803	0	16,405	86,023
Total	**65,677**	**571,008**	**2,017**	**33,655**	**672,357**

Table 11. Oil production by county and company, 1997; source: Virginia Division of Gas and Oil.

County	Field Company	Number of Producing Wells	Volume (barrels)
Lee	**Ben Hur-Fleenortown Oil**		
	APACO Oil and Gas Co.	4	426.69
	Amvest Oil and Gas Inc.	1	152.50
	Ben Hur Oil Co.	5	1,028.00
	Eastern States Exploration	1	1,031.00
	Evan Energy Company, LC	2	279.00
	United Well Services	2	544.60
	Witt Oil Drilling	1	92.00
Subtotal		16	3,553.79
	Rose Hill Oil		
	Evan Energy Company, LC	1	69.00
	Pride Oil Company	1	1,458.37
Subtotal		2	1,527.37
Lee Total		**18**	**5,081.16**
Wise	**Roaring Fork Gas**		
	Equitable Reources Energy Co.	44	5,255.91
Wise Total		**44**	**5,255.91**
State Total		**62**	**10,337.07**

Table 12. Natural gas production by county and company, 1997; source: Virginia Division of Gas and Oil.

County	Company	Number of Producing Wells	Volume (Mcf)
Buchanan	**Conventional and Shale Gas**		
	Blazer Energy Company	47	844,837
	Cabot Oil & Gas Corporation	7	86,032
	Columbia Natural Resources	105	1,454,689
	Eastern American Energy	4	44,685
	Peake Operating	1	41,113
	Penn Virginia Resources	2	14,431
	Pocahontas Gas Partnership	2	37,365
	Virginia Gas Company	44	419,919
		212	**2,943,071**
	Coal-bed Methane		
	Consol, Inc.	288	11,550,416
	Equitable Resources Energy	14	480,407
	Island Creek Coal Company	53	872,372
	Pocahontas Gas Partnership	313	19,277,684
	Ratliff Gas Company	1	
		669	**32,180,879**
Buchanan Total		**881**	**35,123,950**
Dickenson	**Conventional and Shale Gas**		
	Columbia Natural Resources	33	586,207
	Elliott Production	2	25,346
	Equitable Resources Energy	356	5,824,157
	Pine Mountain Oil and Gas	9	126,380
	Virginia Gas Company	26	797,903
		426	**7,359,993**
	Coal-bed Methane		
	Equitable Resources Energy	279	6,457,275
		279	**6,457,275**
	Dual Completion		
	Equitable Resources Energy	2	36,550
		2	**36,550**
Dickenson Total		**707**	**13,853,818**
Lee	**Conventional and Shale Gas**		
	Amvest Oil and Gas Co.	1	2,641
Lee Total		**1**	**2,641**

Table 12. (continued) Natural gas production by county and company, 1997; source: Virginia Division of Gas and Oil.

County	Company	Number of Producing Wells	Volume (Mcf)
Russell	**Conventional and Shale Gas**		
	Pine Mountain Oil and Gas	2	7,557
	Coal-bed Methane		
	Equitable Resources Energy	30	509,940
Russell Total		**32**	**517,497**
Scott	**Conventional and Shale Gas**		
	Equitable Resources Energy	4	15,326
Scott Total		**4**	**15,326**
Tazewell	**Conventional and Shale Gas**		
	Cabot Oil & Gas Corporation	19	554,169
	Columbia Natural Resources	6	89,461
	CNG Producing	2	6,325
	Dominion Appalachian	2	29,429
	Exploration Partners	1	25,863
	R & B Petroleum	2	26,864
Tazewell Total		**32**	**732,111**
Wise	**Conventional and Shale Gas**		
	Amvest Oil and Gas	6	26,646
	Equitable Resources Energy	334	7,069,832
		340	**7,096,478**
	Coal-bed Methane		
	Equitable Resources Energy	17	629352
		17	**629352**
	Dual Completion		
	Equitable Resources Energy	4	265610
		4	**265610**
Wise Total		**361**	**7,991,440**
SUBTOTAL	**Conventional and Shale Gas**	**1,017**	**18,167,498**
	Coal-bed Methane	**995**	**39,777,093**
	Dual Completion	**6**	**302,160**
STATE TOTAL		**2,018**	**58,246,751**